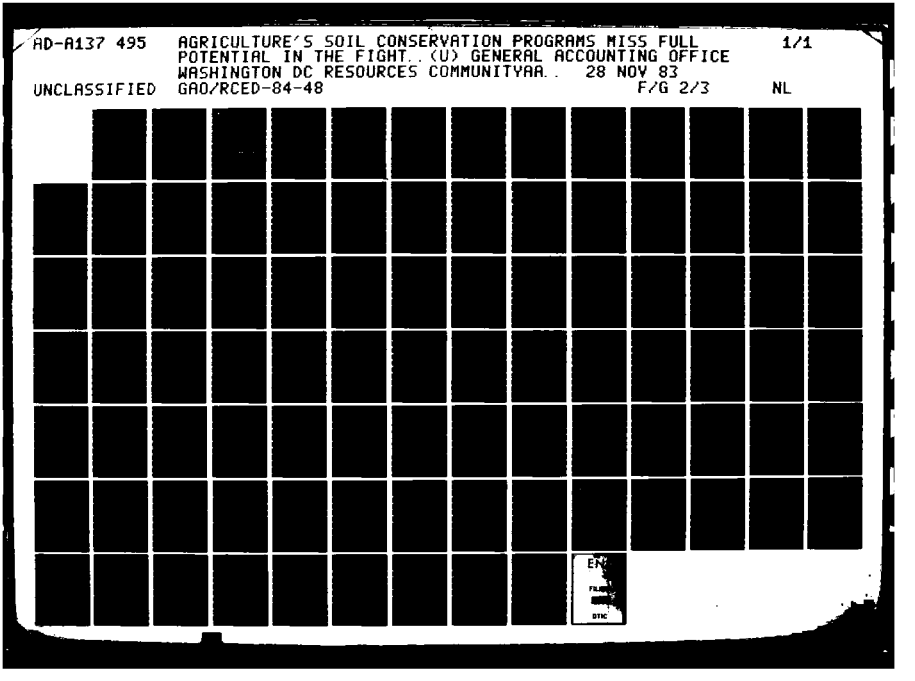

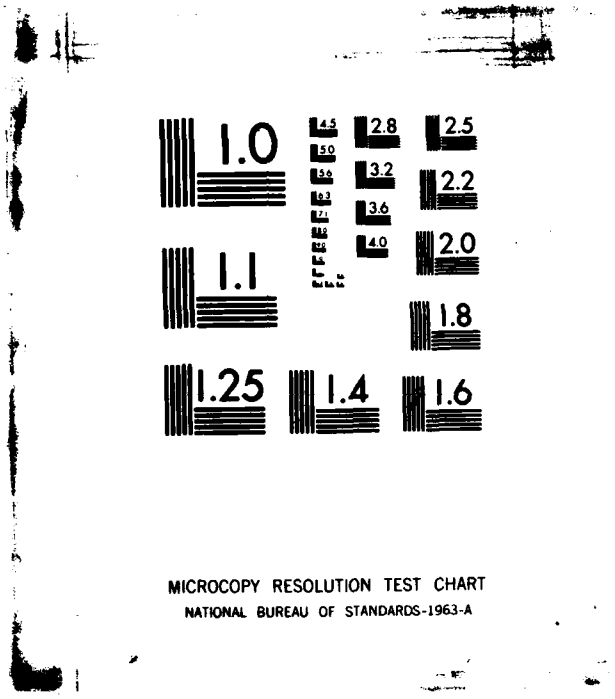

(2)

BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Agriculture's Soil Conservation Programs Miss Full Potential In The Fight Against Soil Erosion

Indications are that soil erosion is becoming more serious and Department of Agriculture programs are not keeping pace with the current rate of erosion. Agriculture's conservation resources, including financial and technical assistance, can be used more effectively in combating soil erosion and its harmful effects--especially on the nation's productive lands. These lands must be maintained and protected to ensure food for future generations.

Agriculture has recognized that soil erosion is its highest conservation priority, but to achieve maximum long-term effectiveness in its soil erosion efforts, it must compile and quantify data on erosion's harmful effects, prioritize those harmful effects, and allocate conservation resources accordingly. Agriculture also should expand, improve, and move ahead on a number of initiatives dealing with specific erosion abatement practices that should help program managers improve conservation resource use at the local level in the near term.

GAO/RCED-84-48
NOVEMBER 28, 1983

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

B-212890

To the President of the Senate and the
Speaker of the House of Representatives

This report discusses the soil erosion aspects of the Department of Agriculture's three major conservation programs--the Agricultural Conservation Program, the Conservation Operations Program, and the Great Plains Conservation Program. We made this review to obtain information on the seriousness of soil erosion; assess Agriculture's bases for allocating resources to, and measuring the results of, these three programs; identify possible changes that could improve the programs' effectiveness; and follow up on recommendations in our previous soil conservation report to the Congress (CED-77-30, Feb. 14, 1977). This report contains recommendations to the Secretary of Agriculture on pages 20, 21, 35, 46, and 57.

We are sending copies of this report to the Senate Committees on Agriculture, Nutrition, and Forestry; Appropriations; Budget; and Governmental Affairs; and to the House Committees on Agriculture, Appropriations, Budget, and Government Operations. We are also sending copies to the Director, Office of Management and Budget, and to the Secretary of Agriculture.

Charles A. Bowsher

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

AGRICULTURE'S SOIL CONSERVATION PROGRAMS MISS FULL POTENTIAL IN THE FIGHT AGAINST SOIL EROSION

D I G E S T

Soil erosion continues to be a serious national problem despite nearly 50 years of federal technical and financial assistance. The U.S. Department of Agriculture (USDA) has three major conservation programs that help farmers and ranchers fight soil erosion--the Agricultural Conservation Program (financial assistance), the Conservation Operations Program (technical assistance), and the Great Plains Conservation Program (financial and technical assistance)--but these programs, costing nearly $18 billion since their inception, have not had as great an impact in ameliorating soil erosion's harmful effects as they might. In addition to fighting soil erosion, these programs have other objectives dealing with water conservation, environmental quality, forestry, wildlife, and other natural resource concerns. This report deals only with soil erosion which USDA has identified as its highest conservation priority.

GAO made this review because of concerns--expressed in the media, within USDA, and among soil conservation experts--about the seriousness of soil erosion and the sufficiency of federal soil conservation efforts; congressional interest in past GAO soil conservation reports; and interest expressed during congressional appropriations hearings about the operation of USDA's conservation programs.

HARMFUL EFFECTS OF EROSION ARE REAL BUT ILL DEFINED

USDA has estimated that, on nonfederal lands, about 6.5 billion tons of soil are displaced annually by erosion--roughly equivalent to 43 million acres losing an inch of soil a year. Indications are that soil erosion is becoming more serious and that USDA programs are not keeping pace with the problem. Not only can erosion impair the productivity of the cropland and rangeland where it occurs (onsite damage), but the eroded soil can pollute air and water, damage property, and cause other problems elsewhere (offsite damage). Although scattered bits of information hint at erosion's effects, needed data are not available to give

a clear, full reading on the consequences and costs to the nation of erosion's harmful effects. (See pp. 7 to 12.)

In working to obtain needed data on erosion's harmful effects through research and other means, USDA needs to specifically address concerns about (1) the unavailability of enough data on the amount of erosion caused by wind (USDA is compiling more data on this), (2) the different implications of erosion on land of different productive capabilities, and (3) the appropriateness of USDA soil erosion tolerance levels (the maximum erosion rates permissible if the soil is to sustain its long-term regenerative capacity and maintain productivity levels). (See pp. 12 to 16.)

BETTER DATA ON EROSION'S HARMFUL EFFECTS WOULD ENABLE BETTER ALLOCATION OF CONSERVATION RESOURCES IN THE LONG TERM

Damages incurred onsite and offsite are the true costs of erosion and should constitute the basic yardstick for USDA's allocation of conservation resources. However, data that would enable allocations of resources to be made according to the importance of erosion's harmful effects are not now available. Until USDA obtains and analyzes sufficient useful data on the extent of erosion's harmful effects, USDA officials cannot be sure that federal program resources under all three major conservation programs are obtaining the greatest benefit for the resources spent. (See pp. 7 to 16.)

USDA's current resource allocations

In its September 1982 national program for soil and water conservation, required by the Soil and Water Resources Conservation Act of 1977, USDA identified soil erosion as its highest conservation priority. However, USDA's decisions for allocating resources to combat soil erosion through its three major conservation programs have generally been predicated on factors such as the number of farms in a county or the number of farmer/rancher applications for assistance--factors not directly linked to minimizing erosion's harmful effects. (See pp. 11, and 22 to 32.)

For its Great Plains Conservation Program, USDA continues to use factors such as those described

above to allocate resources and has not conducted a major evaluation of the program as it has done for the Agricultural Conservation Program and is doing for the Conservation Operations Program. However, an evaluation is scheduled to start in January 1985. (See pp. 31 and 32.)

USDA's planned resource allocations

For its Conservation Operations Program and Agricultural Conservation Program, USDA has modified and/or plans to modify its resource allocation approaches to take into account such factors as (1) the amount of soil erosion that is occurring, (2) the desirability of maintaining a minimum level of conservation activity for a broad area, and (3) the competing needs of program objectives other than soil conservation. (See pp. 24, 25, and 27 to 30.)

Under these approaches, judgments on relative erosion abatement needs will be based largely on the extent of soil displacement. Yet, a direct correlation does not always exist between the extent of soil displacement and the degree of harm and damage resulting from that displacement. Some of the nation's most seriously eroding soils may also be among its least productive ones. Additionally, some deep but highly erosive soils can tolerate erosion with little or no impact on productivity while shallower soils that erode at lower rates can suffer larger productivity losses. (See pp. 22, 23, and 35.)

GAO believes that USDA should allocate its soil conservation resources on the basis of the relative importance of the harmful effects of soil displacement caused by erosion and should obtain data that would enable it to do so. However, until such information about erosion's damaging effects becomes available, USDA's current and proposed allocation approaches, may be the way to proceed for now. (See pp. 22, 23, and 35.)

SOME IMPROVEMENTS ARE POSSIBLE IN THE NEAR TERM FOR MORE EFFECTIVE USE OF RESOURCES AT LOCAL LEVELS

It may be some time before USDA is able to obtain the optimum data needed on erosion's harmful effects and to allocate soil conservation resources on that basis. However, in terms of deciding which specific erosion abatement

practices are most effective in reducing soil displacement, USDA has initiated or is considering several promising approaches as discussed below. GAO believes these approaches should be pursued and expanded to help managers improve conservation resource use at the local level. (See pp. 37, 38, and 41 to 45.)

Cost/benefit information

Using information and methodology developed during an internal evaluation of its Agricultural Conservation Program, USDA has collected some data and is collecting more which could provide, at the local level, statistically valid cost/benefit information about the effect of specific soil conservation practices at various erosion levels. GAO believes that this information, when fully developed through USDA's conservation reporting and evaluation system, should be used at local, state, and national levels for evaluating the effectiveness of past decisions on cost sharing and as a guide for future decisions on how best to use limited conservation resources. As of October 1983, each of the nation's 3,000-plus counties was collecting data from which such cost/benefit information could be developed. (See pp. 37 to 40.)

Variable-rate cost shares

USDA is conducting a voluntary pilot project at the county level to test the concept of varying the rate of federal cost-share assistance for Agricultural Conservation Program practices--the more effective conservation practices would receive a higher rate of federal cost sharing. GAO believes that the pilot project should be expanded to a statistically valid sample of counties and, if test results are favorable, the concept should then be expanded programwide. GAO also believes that the feasibility of variable-rate cost shares for the Great Plains Conservation Program should be tested since it is similar in many ways to the Agricultural Conservation Program. (See pp. 41 to 43, and 45.)

Conservation tillage

USDA officials and others knowledgeable about soil conservation believe that soil erosion could be reduced substantially through more widespread use of conservation tillage farming

methods, which leave appreciable crop residue on the land. This, in turn, decreases the amount and rate of water flow, thereby reducing erosion. USDA has taken steps to emphasize the possibilities of conservation tillage through its training, instructions, and special projects. Some believe, however, that conservation tillage methods present too many uncertainties and risks. Even though conservation tillage is not the total answer to erosion problems and may be inappropriate in certain geographic and climatic circumstances, USDA should clearly establish its advantages and disadvantages in different situations and aggressively promote and assist in its use or caution against its use, as appropriate. USDA should also reassess its research programs to make certain that conservation tillage research is receiving adequate priority. (See pp. 43 to 47.)

CONCERNS REGARDING THE PURPOSE OF SOME USDA COST SHARING OF APPROVED CONSERVATION PRACTICES

GAO's February 1977 soil conservation report[1] pointed out that many of USDA's cost-shared practices were oriented more to increasing production than to reducing soil erosion. As a result of the report, subsequent appropriation acts and USDA policy specified that conservation funds were to be used for enduring conservation measures and not for measures primarily production oriented. Some of the practices GAO cited, such as installing drainage systems for wet fields or applying lime or other minerals to cropland, are no longer approved for cost sharing since these practices would or should be performed in the course of normal farming/ranching operations. (See p. 48.)

However, GAO again raises some important questions about the purpose of USDA's cost sharing of conservation practices in certain situations. For example, one practice--the establishment of permanent vegetative cover--can be particularly effective in reducing erosion when the land is

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[1]"To Protect Tomorrow's Food Supply, Soil Conservation Needs Priority Attention" (CED-77-30, Feb. 14, 1977).

unsuitable (too erosive) for growing crops and will be permanently retired from such use. However, producers receiving cost sharing for this practice are not required to permanently retire the land but can use it for hay and forage production and return it to crop production after 5 years. Therefore, when producers apply this practice to increase hay or forage production or as part of a normal crop rotation system, as is sometimes the case, they receive federal cost sharing for normal farming or ranching operations.

Under the Agricultural Conservation Program, practices to install, improve, or maintain some sort of vegetative cover on land accounted for 40 percent or more of the cost sharing in 1981 and 1982. Such practices also accounted for a substantial part of cost sharing under the Great Plains Conservation Program. (See pp. 51 to 57.)

RECOMMENDATIONS TO THE SECRETARY OF AGRICULTURE

GAO recommends that the Secretary take the following actions to improve USDA's conservation programs.

--Establish and follow a policy that reducing erosion's harmful effects (instead of reducing the amount of erosion) is USDA's primary conservation objective. (See p. 35.)

--Obtain needed data on the effects (harm) of erosion, erosion tolerance levels, and conservation tillage. (See pp. 20, 35, and 46.)

--Obtain and use meaningful and valid data on the cost effectiveness of conservation practices to be federally cost shared. (See p. 46.)

--Expand the variable-rate cost-share pilot project in the Agricultural Conservation Program to obtain a statistically valid sample and, if results are favorable, expand the concept programwide. (See p. 46.)

--Test the feasibility of variable-rate cost sharing for the Great Plains Conservation Program. (See p. 46.)

--Establish specific guidelines and requirements to ensure that the federal government does not

cost share practices used primarily to enhance production or defray normal farming or ranching operating costs. (See p. 57.)

AGENCY COMMENTS AND GAO EVALUATION

USDA agreed with most of GAO's conclusions and recommendations and said that the validity of measuring the degree of erosion's damages by amounts and rates of erosion is rightfully questioned. USDA also agreed that erosion's harmful effects should be the criterion by which soil conservation resources are allocated. GAO made some revisions in the final report to clarify its discussions and to give recognition to additional information provided by USDA. (See pp. 21, 24, 25, 35, 36, 46, 47, 57, and 58.)

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ABBREVIATIONS

ACP	Agricultural Conservation Program
ARS	Agricultural Research Service
ASCS	Agricultural Stabilization and Conservation Service
CNI	Conservation Needs Inventory
COP	Conservation Operations Program
CRES	Conservation Reporting and Evaluation System
GAO	General Accounting Office
GPCP	Great Plains Conservation Program
NRI	National Resources Inventory
OTA	Office of Technology Assessment

ABBREVIATIONS

RCA	Soil and Water Resources Conservation Act
SCS	Soil Conservation Service
USDA	U.S. Department of Agriculture

CHAPTER 1

INTRODUCTION

Soil erosion is a continuing national problem even after many years of federal technical and financial assistance. The erosion process occurs naturally, primarily as a result of water and wind movements. With the added element of human involvement, erosion can be intensified to a point where the soil's productive layer (topsoil) may be lost for future generations. This is especially true when certain intensive farming practices are used to increase production without proper regard for the resulting degradation of the soil.

Not only has soil erosion been depleting the nation's valuable topsoil, with potentially serious crop productivity consequences, but it has also created damage and pollution problems requiring increased public and private expenditures for cleanup and repair. The productive soil of the nation's lands must be maintained and protected if the United States is to indefinitely meet its domestic food needs and continue to help alleviate or prevent world food shortages.

FEDERAL SOIL CONSERVATION PROGRAMS

For the past five decades, the U.S. Department of Agriculture (USDA), through its Soil Conservation Service (SCS) and Agricultural Stabilization and Conservation Service (ASCS), has administered technical and financial assistance programs whose objectives include helping farm and ranch operators control erosion and preserve topsoil. We focused our review on the soil conservation aspects of the following three major USDA programs that provide for such assistance.

USDA's major conservation programs	Types of conservation assistance	Administering agency	1983 appropriations (millions)
Agricultural Conservation Program (ACP)	financial	ASCS	$190
Conservation Operations Program (COP)	technical	SCS	336
Great Plains Conservation Program (GPCP)	financial and technical	SCS	21

Additional information on these programs follows.

The Agricultural Conservation Program, called the Rural Environmental Assistance Program from 1971 through 1973 and the Rural Environmental Conservation Program in 1974, was authorized by law in 1936 (16 U.S.C. 590g-590o, 590p(a), 590p(f), 590q, 1501-1508, and 1510). The program is designed to encourage the application of enduring soil and water conservation practices on the nation's farms through cost-sharing assistance. This is accomplished primarily through annual or long-term conservation agreements with farmers and ranchers. Other practices approved for ACP cost sharing address environmental quality, forestry, and wildlife concerns. A listing of ACP practices cost shared in 1982 in the states we visited is shown in appendix II.

ACP is the principal channel through which the federal government shares with farmers and ranchers the cost of carrying out federally approved conservation practices to help maintain American agriculture's productive capacity. The program is designed to provide financial assistance to induce a landowner/operator to increase conservation efforts. It is not designed to finance normal operational or production practices or to finance conservation practices that would have been carried out without the cost-sharing incentive.

Program regulations authorize the government to pay as much as 90 percent of the cost of carrying out approved practices up to a maximum of $3,500 per farmer per year. SCS, through its COP (as discussed on p. 3), provides technical guidance to ACP recipients. The Congress appropriated $190 million for each of the 1982 and 1983 ACPs. The program operates in the 50 states, Puerto Rico, and the Virgin Islands. About 200,000 farmers, ranchers, and woodland owners received cost-share payments for approved practices in 1982.

As the table on the following page shows, nearly three-fourths of the fiscal year 1983 ACP funds were to be distributed under the annual agreements program, and most of the remaining funds were to be earmarked for long-term agreements and for areas targeted for increased assistance.

Distribution of Fiscal Year 1983 ACP Funds

Distribution method	Amount	Percent
	(millions)	
Annual agreements	$140	74
Long-term agreements[a]	20	11
Targeting	19	10
Other, including administration	11	6
Total	$190	101[b]

[a]Long-term (3 to 10 years) agreements are used to involve farmers in a multiyear planning approach to conservation problem solving.

[b]Does not total 100 percent because of rounding.

The program is operated through committees in 50 ASCS state offices and in over 3,000 ASCS county offices. Each state committee consists of the state director of agricultural extension and three to five members appointed by the Secretary of Agriculture. The county committees are under the direction of the state committee and consist of the county agricultural extension agent and three farmers elected by the farmers in the county.

The Conservation Operations Program was authorized by the act of April 27, 1935 (16 U.S.C. 590a-590f). For fiscal year 1983, $336 million was appropriated for this program. This represents about 10,000 staff-years of effort, including nearly 8,000 staff-years for technical assistance. About $224 million was budgeted for technical assistance to landowners or operators to develop conservation plans and apply practices to control erosion; improve the quantity and quality of soil resources; enhance fish and wildlife habitat; conserve energy; reduce upstream flooding; and improve woodland, pasture, and range conditions.

Other program activities include soil surveys, to determine land capabilities; resource inventories, to determine conservation treatment needs; snow surveys, to develop streamflow and water supply forecasts in western states; and plant materials centers, to assemble and test plant species that show promise for use in conservation problem areas.

SCS technical assistance is furnished primarily through field offices supervised by SCS district conservationists who assist farmers and ranchers through more than 2,900 local conservation districts. These districts, which are legal subdivisions of state governments, are managed by citizens familiar

with local problems. Farmers and ranchers become cooperators--participants in SCS programs--when they agree to carry out an SCS-approved conservation plan on their land. According to USDA statistics, COP had about 2.2 million district cooperators as of 1982. More than 800,000 district cooperators receive help on an annual basis.

The Great Plains Conservation Program was authorized by the act of August 7, 1956 (16 U.S.C. 590p(b)) as a special program to help combat the unique climatic hazards of the Great Plains. GPCP was established to encourage farmers and ranchers to voluntarily make needed changes in their cropping systems and land uses to conserve soil and water. One of the program's objectives is to bring about a long-term solution to problems resulting from drought and the cultivation of land unsuited for sustained crop production in designated counties in the 10 Great Plains states.[1]

Under the program, the landowner or operator is required to furnish a land use plan (developed with SCS assistance) that includes soil and water conservation measures to minimize erosion damages and deterioration by natural causes. The landowner or operator may also include in the plan measures to enhance fish, wildlife, and recreation resources; promote economic use of land; and reduce or control agriculturally related pollution. Approved conservation plans then form a basis for GPCP financial assistance contracts covering periods of 3 to 10 years. SCS policy is that the federal cost share cannot exceed 80 percent for any approved practice or $35,000 for any one contract. Contracts can cover several practices. SCS provides GPCP technical assistance and cost-sharing payments to farmers and ranchers in 519 counties of the 10 Great Plains states.

The 1956 law authorized federal appropriations of up to $150 million for GPCP cost sharing and provided the authority to enter into cost-sharing contracts through 1971. In 1969 the Congress increased the authorization amount to $300 million and extended contracting authority to December 31, 1981. In 1980 it changed the authorization amount and contracting authority to $600 million and September 30, 1991, respectively. For fiscal year 1983, the Congress appropriated $21.3 million for the program, including $12.2 million for cost-sharing assistance, $6.2 million for technical assistance, and $2.9 million for administrative costs.

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[1]Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our review objectives were to

--obtain information on the seriousness of the present soil erosion problem;

--assess the bases USDA has used to allocate resources to, and measure the results of, its three major soil conservation programs;

--identify possible program changes that could be made to improve the programs' effectiveness; and

--follow up on recommendations made in our February 1977 soil conservation report to the Congress.[2]

We made our review in accordance with generally accepted government audit standards. We reviewed legislation, congressional oversight and appropriations hearings, and regulations and procedures relating to USDA's three major soil conservation programs to gain insight into the programs' objectives, legislative intent, and operations. We also reviewed USDA's 1980 resource appraisals,[3] 1981 draft program report,[4] and 1982 final program report for soil and water resources.[5] These reports were prepared in response to the Soil and Water Resources Conservation Act (RCA) of 1977 and describe, respectively, resource status, condition, and trends; program alternatives and environmental impact; and USDA's preferred program. We also reviewed the January 1981 ASCS study, "National Summary Evaluation of the Agricultural Conservation Program," and the Office of Technology Assessment's (OTA's) August 1982 study, "Impact of Technology on U.S. Cropland and Rangeland Productivity."

We discussed the extent of soil erosion problems and the nature and operation of USDA's three major soil conservation programs with SCS, ASCS, Agricultural Research Service (ARS), and Extension Service headquarters officials; program personnel

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[2]"To Protect Tomorrow's Food Supply, Soil Conservation Needs Priority Attention" (CED-77-30, Feb. 14, 1977).

[3]"Soil, Water and Related Resources in the United States: Status, Condition, and Trends" (1980 Appraisal Part I). "Soil, Water and Related Resources in the United States: Analysis of Resource Trends" (1980 Appraisal Part II).

[4]"1981 Program Report and Environmental Impact Statement" (Revised Draft).

[5]"A National Program for Soil and Water Conservation" (1982 Final Program Report and Environmental Impact Statement).

in 7 states and 15 counties; and 115 farmers, including program participants and nonparticipants. The farmer interviews were conducted in 1982. We also discussed these matters with persons knowledgeable about soil conservation at Iowa State University, the University of Minnesota, Kansas State University, and Washington State University. We made our review primarily at ASCS, Extension Service, and SCS headquarters in Washington, D.C., and at their state and county offices in the following 7 states and 15 counties:

State	County
Kansas	Gray
	Meade
Minnesota	Goodhue
	Wadena
Iowa	Shelby
	Johnson
Illinois	McLean
	Jackson
South Dakota	Hughes
	Stanley
Tennessee	Chester
	Henderson
Washington	Spokane
	Whitman
	Snohomish

The state offices were selected primarily on the basis of the extent of soil erosion within the states and included both Great Plains (Kansas and South Dakota) and non-Great Plains states. We selected counties within the states to include those with extensive erosion as well as those where erosion was less extensive. Farmers were selected to get geographic coverage within the counties and to provide coverage for a variety of conservation practices. Our selections were not made on a statistical basis; therefore, the results are not projectable. However, we believe that the results of our work demonstrate programmatic conditions that require management attention. Information in this report was updated during the May-October 1983 period through discussions with USDA and OTA officials.

CHAPTER 2

SOIL EROSION IS A SERIOUS AND GROWING PROBLEM, BUT ITS HARMFUL EFFECTS AND COSTS ARE ILL DEFINED

Each year, erosion claims massive quantities of soil. USDA has estimated that, on nonfederal lands, about 6.5 billion tons of soil are displaced annually by wind or water. This is roughly equivalent to 43 million acres losing a 1-inch layer of soil. Whether the nation will be able to indefinitely continue producing enough food at an affordable cost despite erosion is uncertain. Whether the problems and costs associated with sedimentation and other effects of soil displacement can be controlled and tolerated in future years also is uncertain. Indications are that soil erosion is becoming more serious and that USDA programs are not keeping pace with the current rate of erosion. In recent years, high export demands and climbing production costs have led some farmers to maximize production and deemphasize conservation--further adding to erosion problems.

While program managers, soil experts, and much of the general public view erosion as a serious problem, USDA has only sketchy data about its overall harmful effects. Generally, USDA has judged the seriousness of the soil erosion problem in terms of the total amount and rate of topsoil loss and does not have data to adequately consider subsoil conditions, soil renewal rates, or erosion's long-term harmful effect on soil productivity. USDA also lacks adequate comparative data to more clearly establish the relative seriousness of erosion at various locales throughout the nation. It is difficult, therefore, to know with reasonable certainty how the nation's long-term interest can best be served in terms of controlling and minimizing the harmful effects of soil erosion.

USDA needs to identify, quantify, and prioritize, on a national basis, erosion's deleterious effects. Such information should enable program managers at all levels to more effectively address erosion problems and ameliorate erosion's damaging effects. As discussed in chapter 3, an accurate assessment of erosion's harmful effects is essential for efficient and effective resource allocation and meaningful measurement of program results.

EFFECTS OF EROSION

Erosion causes damaging effects both offsite and onsite. Offsite erosion damages can be found throughout the country--washed-out or blown-away dirt clogs roadside ditches and drainage systems and obstructs highway traffic, sections of roads are eroded, air quality and aesthetics are degraded, and crops are damaged or their growth is impaired. About 25 percent of eroded cropland soils ends up in streams, rivers, reservoirs, harbors,

and lakes. Sedimentation restricts flow in streams and drainageways, fills up harbors and channels, impairs fish and wildlife habitats, reduces reservoir storage capacity, reduces the quality and value of water for recreation or consumption, and carries other water pollutants such as pesticides and nutrients. Some of these consequences can be remedied, but at considerable effort and cost.

The August 1982 OTA study contained some estimates, from various sources, of costs associated with erosion but noted that such costs are difficult to quantify. The difficulty of estimating these costs, however, does not make them any less real. Some of the estimates of erosion's costs were: $60 million for dredging (time period not stated) and $25 million for water treatment (1975).

Less apparent to the eye than offsite damage but potentially more significant to the nation and perhaps the world is the onsite damage erosion can have on the productivity of cropland and rangeland through the loss of plant nutrients and a reduction in the soil's nutrient- and water-retention capacity and rooting depth. OTA's study notes that, overall, adequate knowledge about how various soil types are affected by long-term erosion is lacking but the risk is that the land's productive capacity may be impaired permanently. The study also points out that trying to gauge changes in soil productivity caused by soil erosion through a comparison of crop yields can be deceiving because technology--in the short term--can mask the impacts of erosion. Even if excessive erosion does not immediately change current crop yields, it will most likely require farmers to apply more and costly inputs, including fertilizers, hybrid seeds, pesticides, irrigation, and lime. For example, the OTA study included an estimate of $1 billion to $4 billion a year for replenishing lost fertilizer nutrients.

Research is needed to determine erosion's effect on productivity

USDA has recognized that a great deal of research must be done before a definitive relationship between land productivity and erosion can be established. The research would have to be very broadly based since site-specific characteristics would not permit broad projections or generalizations of research results. For example, a number of variables--such as the type of soil, slope of land, temperature, amount and type of rainfall, and type of crop--could render the findings of a study done in one area of the country unsuitable for use in other areas.

In a January 1983 report addressed to research and education agencies and organizations, SCS describes what it believes to be the nation's soil and water conservation research and

education progress and needs.[1] The report lists numerous basic research needs for the consideration of research and extension administrators, scientists, and specialists. Among these needs are 14 listed as being of the highest priority--11 research needs and 3 extension and technology transfer needs.

Listed first among the highest priority research needs is research on erosion/soil productivity relationships (see app. V), including

--crop yield data for noneroded and eroded conditions on a wide range of benchmark soils, for all principal crops, and for specified levels of soil management;

--improvements in soil loss prediction in those areas where the information needed to apply the Universal Soil Loss Equation[2] is not available; and

--the long-term economic aspects of erosion's effects on soil productivity in quantitative terms.

According to the report, under existing technology, program budget and planning decisions are being made without scientifically defensible information, future productivity may be permanently impaired on some of the nation's important soils, and severely limited federal and state resources may be misdirected.

USDA's Agricultural Research Service published a 1984-90 research implementation plan in February 1983. The plan reflects some shift of emphasis among six ARS research areas, including a small increase for the soil and water conservation research area, as the table on the following page shows.

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[1]"Soil and Water Conservation Research and Education Progress and Needs," SCS, Jan. 1983.

[2]The equation is used to estimate average annual soil erosion losses by measuring several variables such as rainfall pattern, topographic conditions, cropping management systems, and application of conservation practices.

Research area	Original emphasis		Revised emphasis		Change	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
	(millions)		(millions)		(millions)	
Soil and water conservation	$ 52	13	$ 58	14	$ +6	+1
Plant productivity	165	40	136	33	-29	-7
Animal productivity	82	20	78	19	-4	-1
Commodity conversion and delivery	77	18	87	21	+10	+3
Adequate human nutrition	27	7	41	10	+14	+3
Integration of systems	10	2	1	3	+3	+1
Total	$ 413	100	$413	100	$ 0	0

The 1983 ARS Program Plan (which preceded the implementation plan) identified three major problems as being "challenges to the long term [20 to 50 years] ability of the United States to sustain agricultural productivity." These were

--an increase in world food needs,

--a decline in the quantity and quality of land and water resources, and

--a decline in the annual rate of increase of agricultural productivity.

According to the proposed research implementation program, however, these long-term "major problems" must be considered in relation to the more immediate problems of high production costs and availability of markets for U.S. agricultural goods. According to ARS, its program needs the flexibility to pursue research goals that would promote farm efficiency and income enhancement because (1) U.S. agricultural production exceeds current domestic needs, (2) the United States is facing an indefinite period of major agricultural commodity surpluses, and (3) highly efficient farm operations and reasonable profits might result in the withdrawal of marginal lands from production--thus helping to conserve nonrenewable land resources.

Our review did not include a detailed look at USDA's research program; therefore, we are not in a position to make specific recommendations on its overall research goals and priorities. However, we believe that given the priority research needs identified in the SCS report, the three major long-term problems noted above, and the need to help program managers use USDA's conservation resources in a way that would more effectively address the effects of soil erosion (as discussed in this report), USDA should reexamine its research needs priorities

pertaining to the relative position of soil conservation research within the overall research program and the relative position of erosion/productivity research within the soil conservation research program.

USDA EFFORTS TO ASSESS CONSERVATION NEEDS

Soil erosion in the United States remains a formidable problem even though USDA has spent $18 billion on soil conservation programs in the last half century. Program managers are concerned about what effects federal conservation programs have had on erosion and how these programs should be structured to be more effective. National, statistically reliable data on erosion, however, have not been available for analysis and assessment of erosion trends and related conservation needs.

USDA made the first Conservation Needs Inventory (CNI) in 1958 and updated it in 1967. The 1958 and 1967 inventories were made for each county in the United States, but the data collected were not sufficient to gauge conservation progress and erosion severity over time. In Public Law 92-419 (Aug. 30, 1972), the Congress authorized a land inventory and monitoring program and directed the Secretary of Agriculture to issue a land inventory report on the nation's soil, water, and related resources every 5 years. The first report in response to this law was the 1977 National Resource Inventory (NRI). USDA considers this to be the first state-by-state, nationally consistent, and statistically reliable estimate of erosion rates. When data from the second NRI are analyzed and published--scheduled for the early part of 1984--comparable erosion data should be available for trend analysis for the first time.

By enacting the Soil and Water Resources Conservation Act (RCA) of 1977, the Congress also required the Secretary of Agriculture to appraise the condition of soil, water, and related resources on nonfederal lands and to develop a national soil and water conservation program to guide USDA's future conservation activities on those lands. In response, USDA prepared the 1980 RCA appraisal which concluded that, while conservation programs had reduced erosion on some agricultural lands, evidence showed that erosion increased overall during the 1970's. Much of the statistical data used in the RCA appraisal was from the 1977 resource inventory.

In September 1982, USDA published its first RCA soil and water program plan. The plan identified soil erosion as USDA's highest conservation priority. According to the RCA appraisal, of the nearly 1.5 billion acres of nonfederal land in the United States, 413 million acres were cropland and about 34 percent

of these cropland acres were eroding at a rate exceeding 5 tons an acre annually,[3] as the following table shows:

Type of nonfederal land	Total acres	Acres with annual erosion rate exceeding 5 tons	
		Number	Percent
	(millions)		
Cropland	413	141	34
Pastureland	133	14	11
Rangeland	408	69	17
Forestland	370	17	5
Total	1,324[a]	241	18

[a]Excludes over 100 million acres classified as "other."

According to the 1977 resource inventory, almost half of all erosion from nonfederal lands originated on cropland, as the following table shows.

Type of nonfederal land	Percent of total acreage	Percent of erosion tonnage
Cropland	27	44
Pastureland	9	5
Rangeland	27	27
Forestland	25	7
Other	12	17
Total	100	100

Various factors make it difficult to gauge the extent and seriousness of soil erosion

USDA needs to expand and refine available data to get a better measure of soil erosion's harmful effects. Not enough data are available on the amount of erosion caused by wind,

[3]USDA generally considers erosion to be excessive when it exceeds 5 tons an acre annually. USDA also recognizes that erosion exceeding as little as 2 tons an acre annually can be excessive on some soils.

the implications of erosion on different categories of land capability, and the tolerance that different soils have for erosion.

More data needed on wind erosion

USDA collected substantial data on water-caused erosion for the 1977 resource inventory. However, wind erosion data were limited to only the 10 Great Plains states because, according to USDA, field personnel in the other states were not trained in wind erosion data collection methodology. Consequently, the severity and extent of reported cropland erosion may be understated. For example, in the Great Plains states, about 18 percent of cultivated cropland acres were eroding above the tolerance level (tolerance level is defined and discussed on pp. 14 and 15) because of water erosion alone. For wind erosion alone, the percentage was 26. On a combined basis, however, the percentage of cropland eroding above the tolerance level was 47. According to USDA, since the 1977 NRI, USDA personnel in all the states have received the required training, and the second resource inventory will compile wind erosion data for all states and will enable a more consistent measure of soil erosion.

Application of conservation resources needs to be considered in terms of land capability

USDA refers to soil suitability for agricultural and other uses in terms of land capability classes. These classes are designated I through VIII. Class I soils have few limitations that restrict their use for commercial crop production. Classes V through VIII are generally not suitable for cultivation and commercial crop production.

According to the 1977 NRI, when erosion is measured in terms of total soil loss volume (tons), 90 percent of cropland sheet and rill erosion[4] occurs in land capability classes I through IV (which account for about 96 percent of all cropland) and 70 percent of the volume loss occurs on land classes II and III (which account for about 77 percent of all cropland), as the table on the following page shows.

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[4]Sheet erosion results in a fairly even, often imperceptible layer of soil being removed from the land's surface. Rill erosion causes numerous small channels up to a few inches deep in the land's surface. Sheet and rill erosion causes 78 percent of water-related erosion on nonfederal lands.

Annual Sheet and Rill Erosion on Nonfederal Cropland

Land class	Cropland acres	Tons of soil lost	Percent	Cumulative percent	Average tons per acre soil loss
	---(millions)----				
I	31.5	86.8	4.5	4.5	2.75
II	187.8	681.1	35.4	39.9	3.63
III	131.7	678.1	35.2	75.1	5.15
IV	43.9	287.5	14.9	90.0	6.56
V	2.3	4.0	.2	90.2	1.75
VI	12.9	145.2	7.6	97.8	11.22
VII	3.1	43.1	2.2	100.0	14.16
VIII	.1	-	-	100.0	0.01
Total	413.3	1,925.8	100.0	100.0	4.66

In contrast to erosion volume, when erosion rate per acre of cropland is considered, the higher soil loss (tons per acre) occurs on land classes VI and VII (less than 4 percent of all cropland). Although the soil loss rates on land classes I through IV are lower, the aggregate soil loss volume is higher because of the greater number of acres involved.

Although about 34 percent of all cropland acres are eroding in excess of the tolerable level of 5 tons an acre, many of these acres are relatively less productive and frequently must be cropped in rotation with hay or pasture or idled for a season to allow for moisture buildup. If these acres continue to be degraded and eventually become depleted through erosion, the lost productivity, although not insignificant, would not approach the significance of lost productivity had this erosion occurred on prime cropland.

Thus, USDA must consider land capability factors when assessing the seriousness of erosion. Soil erosion prevention practices are generally more costly on lands in the classes having lesser capability. Topsoil erosion on long and steep slopes can present expensive erosion control problems. As discussed in chapter 3, we believe that decisions on conservation resource application and targeting need to take into account not only tons of soil displaced but also such factors as land capability, productivity, and topsoil depth. A further discussion of concerns regarding soil depth follows.

No clear answers to questions about a soil's erosion tolerance

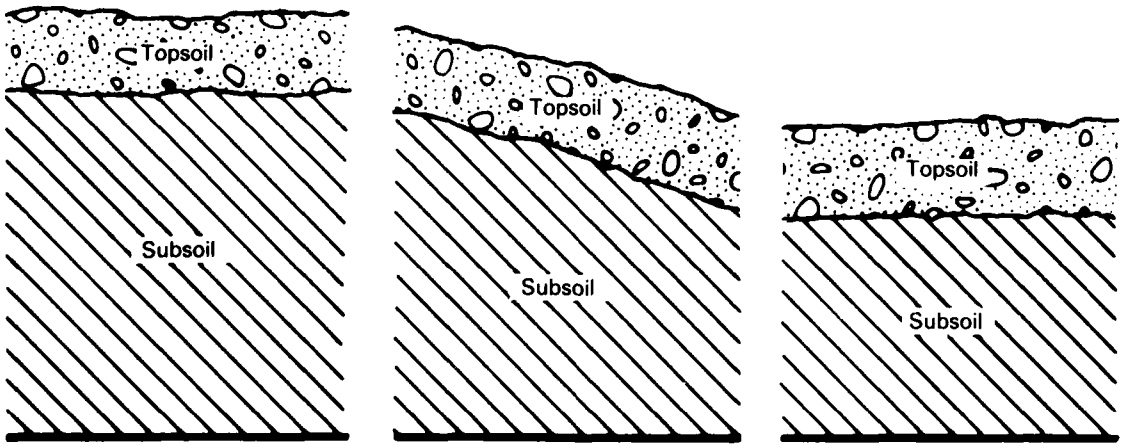
All topsoil has some natural ability to restore lost nutrients, but that ability varies, and some lands can tolerate greater erosion than others. According to SCS, the term "soil

loss tolerance" denotes the maximum soil erosion rate permissible if the soil is to sustain a high level of economical crop productivity for the indefinite future. This tolerance is called the T value, or simply T. Soil losses exceeding T are considered excessive. Certainly, the concept of T is a valid one--at some point in the erosion/regeneration cycle, soil erosion and regeneration must be in a state of equilibrium, but just what that point is for all the nation's various soils has not been scientifically determined.

Controversy exists among soil experts about the limits to which soil erosion can be tolerated before degradation occurs. Critics claim that current T values assigned to specific units of land are the result of collective judgments by a number of scientists and that virtually no scientific, research-oriented basis exists to support those T values. The fear expressed by some critics is that substantial soil degradation and productivity losses will occur if soil erosion occurs at currently assigned T value rates over an extended period. They are convinced that corrected criteria will show that erosion is more serious than currently indicated. USDA officials admit that problems exist with T. However, they say that although not perfect, it is the best method they have for now, and they will have to use it until a better method is developed.

According to the August 1982 OTA study, even if topsoil regeneration keeps up with erosion losses (erosion is within T limits), the erosion may outstrip subsoil formation (from which topsoil is created). Research has indicated that subsoil may form at an annual rate of only one-half ton per acre, while USDA believes that a rule-of-thumb acceptable average annual rate for T is 5 tons per acre for "deep" soils and 2 tons per acre for "fragile" soils. As the following drawing illustrates, the topsoil depth might stay the same after an erosion/regeneration cycle, but a significant reduction could occur in the subsoil depth.

TOPSOIL EROSION/REGENERATION



If this cycle is repeated indefinitely, the ultimate consequence would be soil depletion. In effect, the soil is being mined--used up as an input resource (like fertilizer or water). The implication of the OTA analysis is that USDA should be viewing soil erosion from the bottom of the subsoil to the top of the topsoil when T values are established, instead of considering only topsoil depths.

ECONOMIC FACTORS AFFECT EXTENT OF SOIL EROSION

Although soil erosion occurs naturally, actions by man can accelerate as well as limit the process. Participation in federal soil conservation programs is voluntary, and each farmer has to decide whether or not to install and/or use recognized conservation practices and to what extent. Farm economics play a major role in such decisions.

Voluntary nature of soil conservation

The responsibility for specific farming practices rests ultimately with either the farm owner or operator. Although federal laws and requirements affect some farming practices, such as use of pesticides and proper disposal of animal wastes, they generally do not prevent a farmer's use of farming methods that provide little or no conservation benefits or that actually increase soil loss.

Many farmers willingly cooperate with USDA in adopting recommended conservation practices, but often the cost, even with federal cost-sharing assistance, is a deterrent to installing or using these practices. Typically, the planning horizon for soil conservation activities is long term, and the benefits resulting from conservation money spent today may not be evident to the farmer or society for some time to come. However, an individual farmer's economic planning horizon typically is more short term. Consequently, in times of reduced income, a farmer may be reluctant to spend money on conservation practices--even with federal cost sharing--because of the more immediate economic imperatives of sustaining a household and financing essential farm operating expenses.

Although participation in federal soil conservation programs is voluntary, USDA's 1980 RCA appraisal noted that 15 states,[5] the Virgin Islands, and the District of Columbia had adopted some form of erosion and sediment control laws. For example, a 1971 Iowa act, upheld in 1979 by the Iowa Supreme

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[5]Georgia, Hawaii, Illinois, Iowa, Maryland, Michigan, Montana, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, South Dakota, and Virginia.

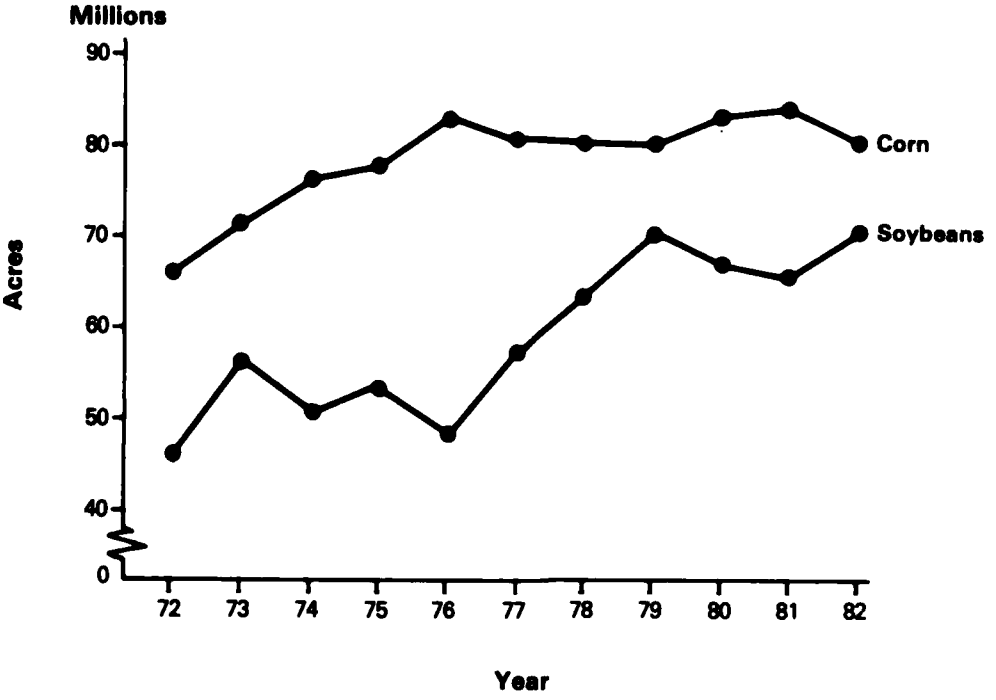
Court, provides that farmers can be forced to install soil and water conservation practices on their land to prevent damage to a neighbor's land.

Export demand and farm income

In recent years, the combination of increased export demand and decreased farm income created pressures to intensify production strategies. Consequently, crop production became more intensified as producers converted to continuous row cropping, which increases the land's exposure to erosive wind and water forces.

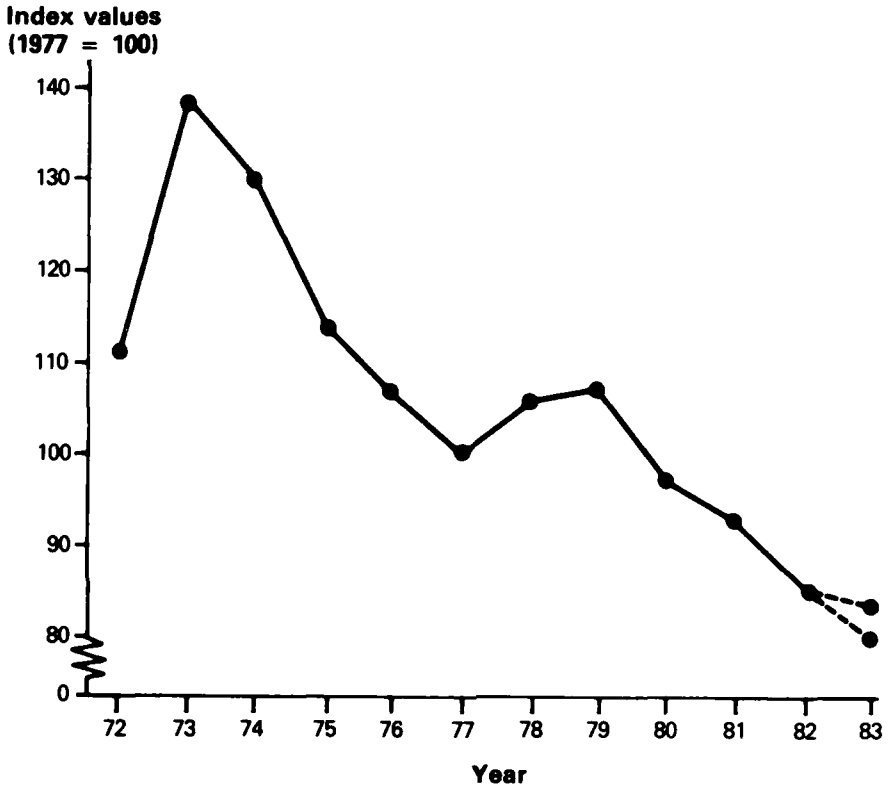
From 1971 to 1982, U.S. grain exports nearly tripled; in 1982 they were estimated to constitute about 50 percent of world grain exports. The United States exported nearly 25 percent of its corn production and 40 percent of its soybean production in recent years. Because of growth characteristics and planting methods, both crops leave the land more susceptible to increased levels of soil erosion. The 1982 levels of harvested acres for corn and soybeans exceeded 1972 levels by 14 million and 25 million acres, respectively. Trends in acres harvested for 1972 through 1982 are shown in the chart below. Since 1973, annual harvested acreage levels for corn and soybeans have averaged 21 and 33 percent higher, respectively, than 1972 levels.

HARVESTED ACRES



From 1973 through 1982, the increase in prices farmers paid for items both directly and indirectly related to production generally outstripped any increased revenues from farm products. The chart below shows the annual prices received/prices paid ratio since 1972 and the projected ratio range for 1983.

PRICES RECEIVED/PRICES PAID INDEX



The above price ratios present a picture of relative financial status attributable to farm production transactions. Although they measure different things, the chart above and the income table on the following page depict mostly similar downward trends since 1973. The one exception is that farm net income shows an increase for 1981 while the prices received/prices paid ratio shows a continuing downward trend since 1979. It should be noted that the farm income data is broader based than the prices received/prices paid index in that total household income is included and certain government loans for crops are considered as sales when the loan is made.

Annual Farm Net Income

Year	Current dollars	1972 deflated dollars
	(billions)	
1972	18.9	18.9
1973	33.4	31.6
1974	26.0	22.6
1975	25.2	20.1
1976	18.7	14.1
1977	18.4	13.4
1978	26.7	17.7
1979	32.3	19.8
1980	20.1	11.3
1981	25.1	12.8
1982	20.4[a]	-
1983	16-20[a]	-

[a]Estimated.

The declining economic well-being of farmers has obvious implications about their ability and willingness to incur expenses for conservation efforts. According to a September 1982 report by the House Committee on Appropriations,[6] "farmers are experiencing serious financial shortages and are finding it difficult to continue their farming operations," and they "are becoming less able to continue to do costly conservation work on their farms . . . ." With farmers under strained economic conditions and faced with food, shelter, clothing, and essential production expenditures, it is not difficult to see why a much needed terrace, for example, might be viewed as a discretionary expense that could or must be deferred until some future time.

Land use conversion

According to the 1977 NRI, about one fourth (395 million acres) of the nonfederal pastureland, rangeland, forestland, and other rural land had potential for conversion to cropland. The conversion potential of this land is shown in the table on the following page. Conversion of most land with high conversion potential could be accomplished by simply beginning tillage. Land with low conversion potential could require considerable investment to convert to cropland. Conversion to cropland, however, also increases the land's exposure to erosive forces. During 1975-80, for example, South Dakota producers converted 1,651,000 acres of grassland to cropland and about 960,000 acres of cropland to grassland--a net cropland increase of 691,000

[6]House report on Agriculture, Rural Development, and Related Agencies Appropriation Bill, 1983 (Report No. 97-800, Sept. 9, 1982, p. 12).

acres. About 43 percent of the 1,651,000 acres of "new" cropland was of marginal quality and highly susceptible to erosion.

Potential for Conversion of Nonfederal Pastureland, Rangeland, Forestland, and Other Rural Land to Cropland

Degree of conversion potential	Millions of acres
High	36
Medium	91
Low	268
Total	395

CONCLUSIONS

Soil erosion is extensive and its consequences are serious and require priority attention even though the problem's actual dimensions are ill defined. The farmer and USDA must know as fully as possible erosion's harmful effects onsite and offsite, if conservation money is to be spent most effectively. Farmers need such information to obtain maximum benefit from conservation decisions and expenditures, and USDA needs this information to establish priorities by which federal staff resources and cost-sharing funds can be distributed to the states. USDA has generally recognized the need for additional data on erosion's harmful effects.

To adequately assess conservation needs and answer critical questions on erosion's long-term impact, USDA needs to obtain and analyze sufficient useful data on how erosion affects a land's productivity, the extent to which soil losses can be tolerated without permanently degrading the land, and the nature and degree of the harm that displaced soil causes. As part of this assessment, USDA needs to reexamine the extent to which research efforts are being directed toward obtaining such data.

RECOMMENDATION TO THE SECRETARY OF AGRICULTURE

We recommend that, to enable program managers to more effectively direct available federal resources to the most serious erosion problems, the Secretary of Agriculture require ARS to reassess its research needs priorities regarding the relative position of soil conservation research within its overall research program as well as erosion/productivity research within the soil conservation research program. Such a reassessment should assure that allocated resources sufficiently address the severity of erosion's threat to the nation's long-term cropland and rangeland productivity. It specifically should

--consider and clearly describe how the ARS program will address the erosion/productivity research needs described in SCS' January 1983 research needs report and

--address the need to resolve the issue concerning the degree to which various kinds of soils can tolerate erosion before degradation occurs (that is, either revise or replace T, the current erosion tolerance criterion).

AGENCY COMMENTS AND OUR EVALUATION

In its July 6, 1983, letter (see app. VI) commenting on a draft of this report, USDA did not comment specifically on the recommendation in this chapter but it did support the need for more research to study erosion/productivity relationships. It said that, for the most part, USDA has assumed in the past that erosion's damages are likely to be greatest where either the erosion rates are highest or total soil loss is greatest, or both, and that this assumption is rightfully questioned in our report. In a subsequent discussion, ARS said that it agreed with and supported our conclusions and recommendation in this chapter.

CHAPTER 3

USDA SHOULD ALLOCATE SOIL CONSERVATION RESOURCES AND ASSESS PROGRAM RESULTS BASED ON EROSION'S HARMFUL EFFECTS

USDA's distribution of soil conservation resources has historically been aimed at allocating such resources among the states on the basis of criteria only indirectly or partially linked to the nation's soil conservation problems and their harmful effects. Allocation criteria have included such factors as the number of farms, acres of nonfederal land, rural population, and number of program participants. The allocations have been very broadly based and have been characterized as "a something-for-everyone strategy." Requests for SCS assistance have often been handled "cafeteria style"--that is, on a first-come-first-served basis. Requests for ASCS assistance have also been handled on a first-come-first-served basis despite ASCS regulations not to do so. Assessments of program results generally have been based on such things as the numbers of farmers assisted and numbers and types of practices being cost shared and installed or used. Currently, through the RCA process (see pp. 5 and 11), USDA has identified excessive soil erosion as its highest conservation priority and has changed--or is considering changes to--its conservation resource allocation systems.

We believe that resources allocated for soil conservation should be directed toward minimizing serious erosion damage both onsite and offsite (see pp. 7 and 8) and that program assessments should be based on how well this is being accomplished. However, data available to USDA at the time of our review did not lend itself to meaningfully quantifying erosion's harmful effects. It is therefore difficult to adequately judge the relative significance of individual erosion problems competing for limited conservation funds.

USDA has begun, and plans to expand, a program to set aside resources for targeted areas of the country identified as having critical needs. We agree with the need to supplant the current methods of resource allocation with distribution formulas based on relative need. The problem, however, is defining relative need. Both the targeting program and the criteria used for basic allocations demonstrate that USDA is basing its definition of relative soil conservation needs more on the amounts of soil being displaced and other reasons than on erosion's detrimental effects. This approach may be necessary in the short term because, as pointed out in chapter 2, only limited data are available to define erosion's onsite and offsite effects. However, it must be recognized that a direct correlation may not exist between the amount of soil movement and the degree of harm and damage resulting from that movement.

This is especially true when considering erosion's effect on productivity. A danger exists that targeted money could, in

some cases, be spent on highly eroding but relatively less productive land at the expense of fragile land[1] that may be more productive but less erosive. Additionally, targeted money could be spent on deep, highly erosive lands that can tolerate erosion losses with little or no short- or mid-term impact on productivity at the expense of shallower soils that may erode at lower rates but suffer larger and more immediate productivity losses.

If two different states or counties each has an acre of land eroding at a rate of 6 tons per acre and money is available to treat only one acre, which acre should--on an "effects" basis--get the treatment? This kind of question requires a number of judgments and considerations that USDA is not fully prepared to provide at this time. Adequate analysis of the situation would require a good knowledge of erosion's actual and potential effects on productivity (onsite effect) and a quantification of erosion's offsite damages. These two kinds of effects are the true costs of erosion and should constitute the basic yardstick to allocate resources. If conservation funds were sufficient to remedy all erosion problems, analysis of priority needs would not be necessary--but this is not the case. Therefore, to maximize the effectiveness of each conservation dollar spent, USDA needs to adequately prioritize soil erosion's harmful effects and allocate conservation resources accordingly.

RESOURCE ALLOCATIONS AND ASSESSMENTS--INITIATIVES AND NEEDS

As discussed in chapter 1, USDA's three major conservation programs have a number of congressionally established objectives in addition to controlling erosion from agricultural land--the subject of our review. Therefore, USDA must spread its conservation resources over such activities as water conservation, water quality improvement, and salinity control; control of pollution from animal wastes; snow and soil surveys; operation of plant materials centers; enhancement of fish, wildlife, and recreation resources; conservation of energy; and improvement of woodland, pasture, and range conditions. To the extent that conservation resources are directed toward furthering these objectives, the amounts available for addressing soil erosion--the objective USDA has identified as the priority area of concern for its conservation efforts--are decreased. As discussed in the remainder of this chapter, USDA is trying or planning to take all competing needs into account in developing a better basis for resource allocations.

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[1]Fragile land is land that (1) has relatively shallow topsoil and undesirable subsoil characteristics and (2) could have its productivity levels sharply diminished by relatively low erosion rates.

Agricultural Conservation Program

Resource allocations

ACP funds are allocated to the ASCS state offices; the state offices in turn allocate funds to the county offices; and the county offices, acting at the direction of the county committees, provide financial assistance to individual farmers. Fiscal year 1982 program obligations totaled about $186 million and ranged from $21,000 for the Virgin Islands to $17 million for Texas. A listing of program obligations and outlays by state for fiscal year 1982 is included as appendix I.

ASCS officials told us that each year since the 1950's (through fiscal year 1982), each state had received about the same proportionate share of ACP total funding, with some minor adjustments based on whether the state had used all of its prior-year allocation. Allocations since 1967 were said to have been based on the 1967 Conservation Needs Inventory (CNI) from which ASCS estimated the types, numbers, and costs of practices each state needed. However, a direct relationship between the CNI results and the conservation funds allocated to each state over the ensuing years is not readily discernible. The 1967 conservation needs data have resulted in relatively minor state allocation adjustments. One reason for this is the ASCS policy that each individual state's share of allocations not be decreased more than 1 percent a year. This policy has been in effect since the mid-1950's.

The following table shows the seven states whose percentage of national ACP funds each increased the greatest amount during 1974-83. All of these increases came about through redistribution of about 2 percent of the national allocation.

Changes to Percentage of National ACP Funds Allocated to Each State--1974-83

State	Percent of total 1974	Percent of total 1983[a]	Percent of increase: 1974 to 1983
Alaska	0.07	0.15	114
Hawaii	0.17	0.31	82
Maine	0.77	1.24	61
Washington	1.74	2.46	41
New Hampshire	0.25	0.34	36
Rhode Island	0.03	0.04	33
Arizona	0.89	1.15	30

[a]Special projects and targeted funds were excluded in computing the 1983 figures.

The 16 states receiving the greatest decrease in their respective percentages of total national ACP funds during 1974-83 are as shown in the table on the following page.

State	Percent of decrease
Georgia, Kentucky, North Carolina, South Carolina, and Virginia	15
Mississippi	11
Illinois, Indiana, Iowa, Maryland, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, and Tennessee	9

Eleven of the 16 states receiving the most significant percentage decreases in their allocations are considered to have serious conservation problems to the point of having been selected or identified by USDA to receive increased funding through its "targeting" program.

At the state level, varying methods have been used to allocate ACP regular funds (excludes targeting and special projects funds) to local (county) offices. Of the seven state ASCS offices we visited, five--Iowa, Kansas, Minnesota, South Dakota, and Tennessee--have historically allocated these funds on the basis of prior-year expenditures and continued to do so. The original basis for the historical allocations was not documented but ASCS officials told us that the allocations were based on conservation needs inventories. In Washington, the ASCS state office released funds to the county offices on the basis of the number of cost-share applications the county offices submitted.

For 1982, the ASCS Illinois office changed from its past method of allocating ACP regular funds based on prior-year expenditures and allocated only 50 percent on that basis; the other 50 percent was allocated on the basis of data as to where soil losses were exceeding tolerance levels. Annual increases to individual counties were limited to 10 percent of their prior-year allocations. Although Illinois was the only one of the seven states we visited with specific soil loss data by county, the others had some general data on high-erosion areas within their respective states.

Assessment of results

USDA's measures of ACP accomplishment for erosion control and other purposes (as shown in the table on the following page) give some indication of program activity but do not show to what extent erosion and its effects were abated. Many of the cited practices reduce soil displacement and help ameliorate erosion's damaging effects. However, the information in the table does not provide a measure of program effectiveness. More important than knowing, for example, that 427,000 acres were terraced, in 1982 would be knowing that (1) the most needy and deserving 427,000 acres, in terms of onsite and offsite damages, were terraced and (2) the most effective mix of program practices was

accomplished. Could there have been greater and better impact, say, if only 300,000 acres were terraced and the remaining money were spent on stripcropping and/or conservation tillage? Answers are not readily available. USDA plans to have two additional erosion data categories for its fiscal year 1984 ACP statistical summary--tons of soil saved and average cost share per ton. These new categories, although better for measuring impact than those in the following table, will not provide a true program effectiveness measure. They will not answer the effectiveness questions posed in this paragraph.

Practice	Unit	Units accomplished 1982 program	Units accomplished Total 1936-82
Water impoundment reservoirs constructed to reduce erosion, distribute grazing, conserve vegetative cover and wildlife, or provide fire protection and other agricultural uses	1,000 structures	1/	2,516
Terraces constructed to reduce erosion, conserve water, or prevent or abate pollution	1,000 acres	427	37,724
Stripcropping systems established to reduce wind or water erosion or to prevent or abate pollution	1,000 acres	125	115,527
Trees or shrubs planted for forestry	1,000 acres	256	7,760
Wildlife conservation	1,000 acres	63	14,718
Sediment pollution-abatement structures or runoff control measures	1,000 acres	792	18,910
Conservation tillage, including reduced tillage and no-till	1,000 acres	733	2,248
Forest tree stands improved for forestry purposes, erosion control, or environmental enhancement	1,000 acres	54	5,056

In January 1981, ASCS published a national summary evaluation of its ACP. The evaluation was based on an analysis of nearly 61,000 program practices cost shared from 1975 through the first half of 1978. The data were collected from 171 counties in 46 states. The report concentrated on identifying ways to increase the amount of soil and water saved through the program and opportunities to reduce costs. It did not address the value of conservation benefits or the cost of technical assistance. Also, the study relied on T values for comparative analyses while acknowledging that T "does not consider such factors as soil fertility, soil depth, economic impacts or offsite beneficiaries, or the cost of reducing erosion [and] therefore, any conclusion from the study must be qualified to reflect those limitations." The evaluation, however, provides a perspective on the relative costs of various soil conservation practices used to combat erosion under various levels of severity (severity measured as tons/acre/year). (See p. 38.)

The following are some of the evaluation's findings pertaining to soil erosion and soil conservation practices:

--More than 52 percent of the sampled practices were installed on lands eroding at less than 5 tons/acre/year.

--County committees lack a firm basis for targeting assistance because they do not have the requisite information about erosion's severity.

--Effectively targeting erosion control funds could more than triple the amounts of soil saved.

One of the report's recommendations was that

> "To direct assistance to serious erosion problems, county committees need adequate information on the nature and severity of erosion problems and the economic impact of alternative solutions prior to approving requests for assistance. Committees should use this information to distribute assistance among applicants according to the extent and efficiency with which soil erosion problems will be solved."

We concur in this recommendation but would add one condition--that the "nature and severity of erosion problems" be defined in terms of onsite and offsite damages and not as a function of the amounts of soil displaced.

Conservation Operations Program

Resource allocations

COP technical assistance is usually provided locally to ASCS or directly to the farmer when requested and with no assurance that such assistance reflects national priorities.

Traditionally, it has been provided on a first-come-first-served basis. If national priorities developed through the long, expensive RCA process are to have any meaning, SCS must develop a system that prioritizes and tracks staff time and activities and reflects national priorities. Without such a system, management will not have the necessary data to optimally allocate staff or to properly evaluate their activities once they are allocated.

The national COP resource allocation system was developed in the 1940's and, according to an SCS official, has been based primarily on the number of conservation districts and the SCS staff serving the districts. Each time a new district was established, funds were increased to provide staff and the increased staffing level then became part of the new base for determining the next year's allocation. Three other factors have been considered in allocating COP resources: acres of nonfederal land, number of farms, and rural population. Use of this allocation basis has meant that at least a minimum level of SCS technical assistance has been available for nearly all agricultural land in the nation. Projected program allocations for fiscal year 1983 are listed in appendix IV by state.

SCS worked out a revised allocation system for fiscal year 1983 that is based on factors that SCS officials say more closely relate allocations to conservation needs. Under this system, 50 percent of a state's COP allocation is based on the four historical factors named above, and 50 percent is based on the following eight factors:

Factor	Percent
Erosion	26.5
Flood prone areas	10.0
Irrigation efficiency	6.0
Range conditions	2.5
Reclamation	1.5
Urbanization areas	1.5
Animal unit density	1.0
Prime farmland conversion pressure	1.0
Total	50.0

SCS officials regard use of the eight new factors as a means of directing more resources to areas where specific conservation needs are greater. They regard use of the original four factors as a means of maintaining a minimum level of conservation activity for the broadest possible area. It is just as important, they say, to maintain the quality and productivity of lands with minimum or moderate erosion levels as it is to treat severely eroded lands.

Besides changing the criteria on which the base-level COP allocations are made to the states, SCS began in fiscal year 1981 to "target" additional resources to areas having more critical and persistent conservation problems of national significance. As the following table shows, a total of $10.6 million was targeted in fiscal years 1981 and 1982 for erosion, water, and salinity problems. The 1981 and 1982 targeted amounts were about 1.7 and 2.8 percent, respectively, of the total technical assistance appropriations. SCS has proposed increasing the amount yearly until targeting represents 25 percent of technical assistance funds by fiscal year 1987.

Purpose/State	Fiscal year 1981	Fiscal year 1982
	(000 omitted)	
Cropland erosion control:		
Alabama	$ 420	$ 690
Georgia	320	525
Idaho	200	330
Washington	496	836
Oregon	144	239
Iowa	546	901
Missouri	294	514
Tennessee	530	875
Kentucky	230	395
Mississippi	115	228
Total	3,295	5,533
Water conservation:		
Idaho	84	147
Montana	98	163
Nevada	29	49
Utah	46	76
Wyoming	97	162
Oregon	55	85
Total	409	682
Salinity:		
Colorado	206	285
Nevada	30	50
Utah	30	50
Arizona	30	-
Total	296	385
Total	$4,000	$6,600

Each of the seven SCS state offices we visited either was already using, had recently changed to, or was considering changing to a COP resource allocation basis that it believed would better reflect local office workload concerns. Previous allocation criteria were being abandoned generally because the data either did not accurately reflect those local concerns or were considered outdated. To a large extent, new allocation levels have been considered merely as goals, and progress toward them has been slow. According to SCS state officials in one state, the shifting of SCS field staff according to allocation levels indicated by workload factors has been hampered because of insufficient funds to support relocations and because SCS state officials are reluctant to relocate staff except on a volunteer basis. In Kansas, for example, nine field offices having the highest indicated workloads had only one or two staff members each, while two field offices having medium indicated workloads had four staff members each.

Assessment of results

On the assessment side, SCS has measured technical assistance accomplishment primarily in such terms as number of clients assisted, services provided, and acres covered by conservation plans. This information does not lend itself to cost/benefit analysis or serve as useful criteria on which to base staff relocation decisions. It merely measures activity levels, not the efficiency or effectiveness of the activity.

In October 1982, SCS began collecting data to evaluate its COP technical assistance activities. Data are to be collected for a 12-month period from 278 statistically selected counties. The evaluation description states that the evaluation will, among other things, allow SCS to

--measure results of COP technical assistance by comparing before-and-after conditions,

--evaluate cost effectiveness of practices in achieving expected or desired results,

--evaluate conservation planning effectiveness,

--estimate erosion's effect on crop yields,

--establish a baseline to be used to measure change in program direction over time,

--attempt to measure effectiveness of COP technical assistance with and without financial assistance,

--compare actual priorities with officially stated priorities, and

--evaluate the distribution of time and funds among the various conservation activities.

This evaluation, when completed, should provide some indication of technical assistance cost/benefit. However, if this evaluation is continued beyond October 1983, USDA should consider modifying the procedures relating to one of the evaluation elements to make the results more meaningful. The procedures provide that if more than one conservation practice is applied on a unit of land, the projected benefits of all practices are considered as one. This does not allow for a cost-effectiveness estimate for each practice, which is a much needed piece of information for both the local technicians in determining where to best use their resources and national program managers in making resource allocation decisions. (See p. 40 for additional discussion.)

Great Plains Conservation Program

Resource allocations

The GPCP includes both financial and technical assistance under long-term contracts with land users in designated counties in the 10 Great Plains states. Cost-share payments normally vary from 50 to 80 percent of the average costs cooperators incur for installing eligible practices. (See p. 56 for some of the types of eligible practices.)

The basis for allocating GPCP funds among the states is not clear. SCS officials provided a list of variables said to be the basis but could not show how the variables were weighted to arrive at the specific amounts allocated to the states. The variables were the

--number of counties in the program;

--number of active contracts in the state;

--number of unserviced applications for contract development;

--number of farms and ranches;

--acreage in program area; and

--available data as to extent of wind and water erosion damage, improper land use, and need to convert cropland to permanent cover.

Except for the last item, these variables are not directly related to possible erosion problems or priorities and, regarding the last item, USDA has not had good data to measure the extent of onsite and offsite erosion damage. The allocations shown in

the following table for the 10 states generally reflect historical allocation percentages with some adjustments for factors such as application backlogs and special project needs.

Fiscal Year 1982 Allocation for Cost-Sharing Payments

State	Amount	Percent
	(millions)	
Colorado	$ 1.5	10.9
Kansas	1.1	8.0
Montana	1.3	9.4
Nebraska	1.3	9.4
New Mexico	1.0	7.2
North Dakota	0.7	5.1
Oklahoma	1.1	8.0
South Dakota	1.3	9.4
Texas	3.5	25.4
Wyoming	1.0	7.2
Total	$13.8	100.0

At the two SCS Great Plains states offices we visited, GPCP applications were processed and funded at the state level on a first-come-first-served basis. As a result, the states did not systematically focus on priority erosion problems.

In recent years, applications for GPCP assistance have exceeded the funds available, causing a backlog of unfilled applications. As of December 1981, for example, the SCS South Dakota office had a backlog of 69 applications, and applicants had sometimes waited a couple of years for funding approval. Because of the long waiting period, one local office had stopped submitting applications to the state office regardless of how serious the needs were considered to be. At one local office in a high-erosion area, an SCS staff member said that he had stopped processing GPCP applications because of the long delays in funding. An SCS state official acknowledged that delays had caused some applicants to drop out.

Assessment of results

SCS has not made an evaluation of GPCP comparable to the ASCS evaluation of ACP or to its own ongoing evaluation of COP. Such an assessment would be very useful, especially in today's environment of budget constraints. According to an SCS official, an evaluation of the GPCP program is scheduled to start around January 1985. The evaluation's format, methodology, and scope had not been determined but, according to the official, would depend somewhat on the results of a USDA Economic Research Service socioeconomic study of the Great Plains states scheduled for completion in January 1984.

Listings and statements of accomplishments for GPCP, like those for ACP and COP, have been in terms of activity levels--how many wells were dug, miles of fence installed, or acres of land placed under permanent vegetative cover--instead of the conservation results of those activities.

OUR PREVIOUSLY REPORTED VIEWS ON DATA NEEDED FOR IMPROVED RESOURCE ALLOCATION

In a January 1982 report,[2] we pointed out that USDA had obtained considerable data on U.S. soil and water resources for its 1981 conservation program report but that the data were not explicit enough to define the extent, causal factors, and implications of the problem, or to permit development of an effective system for addressing the nation's conservation problems within limited budget resources. We said that USDA needed to develop better data on erosion problems, particularly data on the depth of soil and its ability to sustain erosion. For example, shallower soils experiencing average annual erosion rates of less than 5 tons per acre may be more of a concern than deeper soils experiencing higher rates. We also noted that water conservation might be more critical than soil erosion in some areas.

Regarding the erosion problem, we said that USDA should analyze the factors that contribute to high erosion rates. Erosion may be caused directly or indirectly by many factors, including soil characteristics, farm operating conditions, economic conditions, and government programs. For example, government price supports targeted to a few commodities, coupled with the new crop insurance programs, may encourage the expansion of row crops, such as corn and soybeans, on marginal lands. Land in row crops is highly susceptible to erosion and it is difficult to prevent farmers from intensively farming marginal lands. Providing price supports and targeting conservation funds to such areas could encourage increased use of this land base, continue its use in row crop production, and result in increased erosion.

In an earlier report entitled "Framework and Checklist for Evaluating Soil and Water Conservation Programs" (PAD-80-15, Mar. 31, 1980), we had developed a methodology for gathering and analyzing the basic data needed to define the soil erosion problem. The methodology included the following questions:

--How much soil is being eroded by water on cropland, pastureland, forestland, and rangeland?

--What is the effect of this erosion on productivity?

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[2]"Comments on the U.S. Department of Agriculture's 1981 Program Report and Environmental Impact Statement" (CED-82-41, Jan. 29, 1982).

--What is the amount of sediment damage?

--What is the amount of shore and streambank erosion?

--What is the impact of this erosion on water quality?

--What indicators must be used to describe each problem?

--Do the indicators describe the important aspects of each conservation problem?

--What procedures (direct measurement, statistical sampling, descriptive models, or predictive and planning models) are used to assess the extent of each problem?

--To what degree has each predictive and planning model been validated?

--What procedures are used to ensure the accuracy and reliability of the measurements and estimates USDA uses?

These questions describe the type of information USDA should have to define where the greatest needs exist and where its limited resources may be most effectively directed. In responding to this earlier report, USDA said that the list of questions would be helpful in reviewing individual program activities and that "The Department is in full agreement with the need to establish a systematic framework for the evaluation of all programs."

CONCLUSIONS

Past USDA conservation resource allocations to the states have been based on criteria not directly linked to minimizing erosion's harmful effects. Allocations within states generally have been made with little or no assurance that those lands experiencing the most onsite damage or causing the most offsite damage were receiving priority attention. In more recent approaches developed as a result of the RCA (see p. 11), USDA is giving more emphasis to severe erosion areas when allocating conservation resources to the states and increasing the proportion of conservation resources in areas where soil erosion is most critical.

The intent of the new resource allocation approach is good, but not enough information is available on erosion's onsite and offsite damaging effects to ensure that USDA's allocation approaches will produce the best results. Without sufficient information on erosion's effects, USDA has relied on soil displacement data as a measure of "critical needs." A major shortcoming of this criterion is that a direct correlation may not exist between the amount of soil movement and the degree of harm and damage resulting from that movement. This is especially

true when considering productivity. Some of the nation's most seriously eroding soils may also be among its least productive.

Until better information becomes available about erosion's effects (especially long-term productivity effects), USDA's current and proposed approaches for allocating conservation resources, including a limited targeting concept, may be the most practical way to address the erosion problem at the national level. However, these resource allocation methods should be viewed only as short-term, interim measures--the ultimate goal being to allocate conservation resources on the basis of maximizing the national good by minimizing erosion's damaging effects. Also, targeting programs should be approached cautiously with the understanding that targeted money could, in some cases, be spent on highly eroding but relatively less productive land at the expense of fragile land that may be more productive but less erosive. Additionally, targeted money could be spent on deep, highly erosive lands that can tolerate erosion losses with little or no short- or mid-term impact on productivity, at the expense of shallower soils that may erode at lower rates but suffer larger and more immediate productivity losses.

RECOMMENDATION TO THE SECRETARY OF AGRICULTURE

We recommend that, to increase efficiency and effectiveness of USDA soil conservation programs, the Secretary of Agriculture establish a policy that will

--recognize that USDA's primary soil conservation objective is to reduce erosion's harmful effects (onsite productivity losses and offsite damages) as opposed to simply achieving reductions in soil displacement (gross tons or tons per acre) and

--require USDA agencies to allocate conservation funds according to a prioritization of erosion's harmful effects (onsite productivity losses and offsite damages) at the earliest possible time. Similar approaches would need to be followed in the allocation and use of conservation funds at state and local levels.

AGENCY COMMENTS AND OUR EVALUATION

Although USDA did not specifically comment on the need to establish a policy on reducing erosion's harmful effects, it agreed that (1) information on erosion's onsite and offsite effects is essential to effective and efficient resource allocations and (2) funds should be allocated on this basis at the earliest possible time. (See pp. 66 and 69.) It said that its Conservation Reporting and Evaluation System (CRES), a data collection effort begun in October 1982 (see p. 40), "represents the leading edge of the state-of-the-art . . . [for quantifying]

onsite practice impacts" and that development of measurements for offsite impacts is being pursued through pilot projects.

We believe that establishing a formal policy on reducing erosion's harmful effects would provide essential long-term direction and balance for all USDA soil conservation programs, especially in light of recent and proposed "targeting" efforts which seem to rely primarily on soil displacement as the criterion for measuring erosion's seriousness and allocating resources. Such a policy would be consistent with USDA's 1982 National Program for Soil and Water Conservation, which identifies a need for new methods to quantify erosion's onsite and offsite damages.

Concerning a description in our draft report of the relationship between the CNI and the distribution of ACP funds among the states, USDA said that allocations since 1971 have been based on the 1967 CNI and that the cumulative changes over the last decade have caused significant changes to some states' earlier allocations. Additional information included on pages 24 and 25 shows that the most significant cumulative increases in individual state allocations in the last decade have all involved states whose allocations represented relatively low percentages of the funds allocated in the base year--1974 (less than 1 percent in six of the seven states). All of the increases during this 10-year period for the seven states involved came about through redistributions of less than 2 percent of the national allocation. Additionally, 11 of the 16 states receiving the most significant percentage decreases in their allocations are considered to have serious conservation problems to the point of having been selected or identified by USDA to receive increased funding through its "targeting" program.

CHAPTER 4

IMPROVEMENTS IN SOIL CONSERVATION PROGRAMS ARE POSSIBLE IN THE NEAR TERM DESPITE ABSENCE OF ADEQUATE DATA ON EROSION'S HARMFUL EFFECTS

As discussed in chapters 2 and 3, if USDA is to achieve maximum long-term effectiveness in its programs and efforts to abate soil erosion, it must compile and quantify national data on erosion's harmful effects (onsite productivity losses and offsite damages), prioritize those harmful effects, and allocate and use conservation funds accordingly (giving appropriate consideration to other program objectives). Without such an approach, USDA cannot know if national conservation resources are being effectively allocated among and within the states. USDA cannot know, for example, whether a state should (on an "effects" basis) receive a greater or smaller percentage of the available conservation resources or whether a particular county, or farm within a county, should receive higher priority or lower priority than another county or farm.

In the short term, however, even without the needed information on erosion's effects, USDA can take steps to improve the efficiency and cost effectiveness of its soil erosion abatement efforts. This can be done by ensuring that, once funds are allocated to a particular county, only those practices or combination of practices returning the greatest conservation benefits for the dollar spent will be approved.

A MORE COST-EFFECTIVE USE OF CONSERVATION RESOURCES CAN BE MADE NOW

One result of ASCS' 1981 ACP evaluation was cost/benefit data (based on a sample of 171 counties) for the nine practices shown in the table on page 38. The table shows, for each of the nine practices, the average cost to "save" a ton of soil at various levels of pretreatment soil erosion. The costs used in developing this table include ASCS and landowner/operator installation costs but not SCS technical assistance costs. A table such as this, which would include all appropriate practices and would be statistically significant at the local level, could prove valuable to national and state program managers as an aid for evaluating past cost-sharing decisions and as a guide to local ASCS committees in making decisions on how best to use limited conservation resources at the local level. ASCS plans to distribute these data to the states and counties as soon as they are statistically valid.

ASCS officials said that, in October 1983, all the nation's counties (about 3,000) began furnishing data from which such tables could be developed. The tables would be especially useful to local ASCS committees if, where applicable, SCS would

include in its report to the committee a list of alternative practices that could effectively address the erosion problem. Currently, a farmer will apply to ASCS for cost-share funding for a particular practice and an SCS technician, in most cases, will visit the farm to determine whether the practice (1) is needed, (2) can be installed practicably, and (3) is not being installed primarily for the applicant's convenience. If the ASCS committee had this information for several practices--accompanied by a determination of an applicant's willingness or unwillingness to install each such practice--the committee would have a better basis for distributing and stretching its cost-share dollars.

Average Cost Per Ton of Erosion Reduction by Prepractice Erosion Rate
171 Sample Counties
Agricultural Conservation Program
1975-78

Average annual soil loss before treatment (tons/acre)	Type of practice								
	Establish permanent vegetative cover	Improve permanent vegetative cover	Strip-cropping	Ter-race	Diver-sions	Interim cover	Conser-vation tillage	Compet-itive shrub control	Vegetative cover on critical areas
	(Average cost per ton of erosion reduction in dollars)								
0 - 1.00	57.48	69.80	7.57	9.48	28.98	65.52	63.47	11.20	68.39
1 - 1.99	15.97	9.01	7.10	6.91	18.52	61.39	4.98	3.16	5.77
2 - 2.99	6.36	4.91	6.28	3.43	11.24	31.53	2.35	1.58	—
3 - 3.99	4.32	3.04	2.15	3.14	12.18	29.13	1.76	1.64	.29
4 - 4.99	3.81	2.76	.92	4.13	9.91	18.43	1.50	.83	4.38
5 - 5.99	2.93	2.05	1.61	3.60	3.84	15.30	.90	.78	4.37
6 - 6.99	1.89	1.72	1.14	2.68	2.98	15.19	.98	.51	2.96
7 - 7.99	1.81	1.38	.52	2.57	4.67	9.49	.53	.61	.38
8 - 8.99	1.60	1.21	.88	2.66	1.52	7.69	.53	.46	.44
9 - 9.99	1.31	1.07	1.07	2.08	3.79	7.21	.61	.13	.89
10 - 10.99	1.20	1.03	1.43	1.68	2.16	6.77	.39	.33	.84
11 - 11.99	1.00	.84	—	1.95	.49	5.77	.39	.33	.59
12 - 12.99	.85	.66	.30	1.43	.57	5.95	.83	.66	.21
13 - 13.99	.89	.64	1.07	1.12	.99	3.99	.61	1.06	.49
14 - 14.99	.80	.57	—	1.21	.54	3.90	.21	.30	.42
15 - 15.99	.59	.54	.69	.99	.61	3.94	.32	.19	.27
20 - 24.99	.45	.45	.06	.87	.44	3.07	.29	.32	.21
25 - 29.99	.38	.36	—	.76	.63	2.38	—	.03	.26
30 - 49.99	.26	.24	.02	.44	.29	1.81	.08	.51	.25
50 - 74.99	.17	.14	—	.15	.14	2.21	.13	—	.46
75 - 99.99	.14	.13	—	.03	.08	2.19	.04	—	.15
over 100	.10	.06	.01	—	.07	1.36	—	.01	.16

How the cost benefit/tables should be used

An important feature of ASCS' cost/benefit table is that it compares conservation practice costs at various degrees or levels of erosion so that, for any given erosion level, the practices can be ranked on a cost-effectiveness basis. For example, the above table shows that on land eroding at 10 tons per acre, the average cost to save 1 ton of soil is $1.43 if stripcropping is used but $0.39 if conservation tillage is used.

In this situation, more than 3 acres could be treated by conservation tillage (on average) for the same cost as 1 acre treated by stripcropping. Other factors being equal, if SCS determined that either practice would be appropriate for a particular farm, the ASCS committee could give the cost-share application a relatively higher priority if the farmer opted for conservation tillage than if the farmer was only willing to use stripcropping. The farmer might still receive cost-share assistance for stripcropping under this system but only after all other applications in the county had been approved for lands experiencing similar prepractice erosion levels but having greater post-practice cost/benefit profiles. We believe this method is superior to USDA's current allocation process and would be better than basing the decision to install a practice on saving the most soil.

The table clearly shows that if saving the most soil at the least cost were the paramount program goal, then available funds should be directed at those lands with the higher erosion rates. This strategy for directing funds to save the most soil might prove effective if offsite sedimentation or environmental damages were the only measures of erosion's harm that needed to be considered. As pointed out in chapters 2 and 3, however, such a strategy for targeting resources could, in some cases, favor highly eroding but relatively less productive land at the expense of fragile land that may be more productive but less erosive. Additionally, targeted money could be spent on deep, highly erosive lands that can tolerate erosion losses with little or no short- or mid-term impact on productivity at the expense of shallower soils that may erode at lower rates but suffer larger and more immediate productivity losses. Assuming the same or lower funding levels for conservation, any additional funds directed toward targeted high-erosion areas must be obtained either through increased program efficiencies or decreased spending on lands eroding at lesser rates. Because shifts in funds away from fragile but productive soils could have a serious, long-term impact on the nation's food and fiber productive capacity, USDA should proceed with caution in its targeting efforts until more is known about the erosion/productivity relationship.

This caution, however, highlights a major advantage of the ASCS cost/benefit table. By using a table such as the one on page 38 as a guide, local program managers could select the more cost-effective practices for a specific unit of land--whatever the erosion level--without making major operational or financial program shifts, and state and national program managers could use the information to evaluate program results and efficiency. National managers still would not know whether, on an effects basis, a state should receive more or less conservation money but they could be assured that the money reaching the local level is being spent more cost effectively.

USDA is collecting additional cost/benefit data

In October 1982, USDA began a new data collection effort called the Conservation Reporting and Evaluation System (CRES). By October 1983, all the nation's 3,000 plus counties were CRES participants. For participating counties, a CRES data sheet is completed for each conservation practice ASCS cost shares. Many categories of data are collected for each cost-share application, including conservation practice costs and before-and-after erosion rates. With this collection effort, ASCS will have the extensive data needed to develop the cost/benefit tables discussed on page 38. The tables will be developed for local- or regional-level use for a large part of the nation by the end of fiscal year 1984. As discussed above, local ASCS county committees can use the cost/benefit data derived from CRES to more effectively distribute ACP cost-share funds. Additionally, those county offices participating in the variable-rate cost-share pilot project (see pp. 41 and 42) could use this information as a basis for increasing cost-share rates for those who install the more cost-beneficial conservation practices.

One aspect of the CRES project may limit the usefulness of the resulting cost-effectiveness data. Current USDA guidelines for reporting CRES data allow the combined soil erosion reductions of several conservation practices (a "system") to be attributed to a single practice. For example, if ASCS provides cost-share funds for a terrace and the county program requires contour tillage to be applied to terraces, then the combined estimated soil savings of the two practices is attributed to the cost-shared practice and attributed to terraces on the CRES data form. These data do not constitute an appropriate basis for computing a single practice's average cost or in attributing soil reduction results. Computer programs written to analyze CRES conservation practice cost-effectiveness data should be designed to include only those data that can be directly attributed to a single practice. According to USDA, the number of CRES forms reporting single practices will be sufficient to provide a valid analysis.

Methodologies for CRES data analysis will be an evolutionary process

One ASCS official has characterized CRES as "the leading edge of the state of the art" for quantifying onsite conservation practice impacts. The system is new, it is comprehensive, and it will generate a lot of data. ASCS anticipates that as the CRES system matures, the data from this system will be more and more useful for national, state, and local managers. Certainly, it can be expected that CRES data analysis will be an evolutionary process as managers and analysts alike learn more about the system--its capabilities and limitations--and devise and revise analytical methodologies to interpret the data. One

analytical approach we believe USDA should consider is a cost-effectiveness evaluation of SCS technical and management practices similar to the evaluation of ASCS practices depicted on page 38.

ASCS should expand the variable-rate cost-share pilot project

In October 1981, ASCS began a voluntary pilot project to test the acceptance and feasibility of a variable cost-share rate for its ACP. The varying rate was based on either (1) land capability classification (see pp. 13 and 14) or (2) estimated reductions in soil loss achieved by installing or using an ACP practice--the greater the projected soil "savings," the larger the federal share of the practice's total cost. Estimated reductions are computed using the Universal Soil Loss Equation (see p. 9) and the Wind Erosion Equation.[1]

During the pilot project's first enrollment period, 75 counties in 23 states volunteered for participation. ASCS offered another enrollment period for fiscal year 1983 cost-share funds, and an additional 51 counties and 4 states joined the project. Two significant changes were made when the pilot project was continued for fiscal year 1983:

--More emphasis was given to "sensitive" lands that had T values (see pp. 14 and 15) of less than 5.

--The method of determining cost-share levels on the basis of land capability classes was no longer an option for new counties entering the project. For fiscal year 1982, maximum cost-share levels under the land capability classification method varied from 45 percent for category I land to 75 percent for category VII land.

The first change was in response to state and local concerns that protection of fragile soils needed greater emphasis. The second change was made because program officials believed that the land capability classification method for computing cost-share rates did not buy as much conservation as did the soil-loss method.

The soil-loss method sets the federal cost-share rate on the basis of two criteria: (1) the existing (prepractice) erosion rate and (2) the estimated decrease in soil loss attributable to installing or using the cost-shared practice. Between February and November 1982, cost-share-formula products were

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[1]This equation is used to estimate average annual soil losses from wind erosion by measuring several variables such as cropping, management systems, and application of conservation practices.

weighted to favor soils with higher prepractice erosion rates. In November 1982, formula-weighting factors were revised to favor soils with higher soil-loss/T ratios. This was done to "provide more incentive for counties with sensitive soils" (T of 4 or less) to join the volunteer program. (See USDA comments, pp. 76 and 77.)

As pointed out throughout this report, soil displacement is not a good criterion to measure erosion's harmful effects and should not be the sole driving force behind decisions on conservation resource allocations. These decisions should be based on effects data, especially erosion's effect on productivity. But because these data are not currently available and probably will not be available for some time, the next best alternative, in our opinion, would be for USDA to base its variable-rate cost-share allocation decisions on the CRES-generated cost-effectiveness data described above. We believe that the variable-rate cost-share concept is a sound concept but that soil displacement should not be a prime determinant.

We are concerned that aggregating the erosion reduction results of several conservation practices, as could happen under CRES (see p. 40), could undercut the variable-rate concept by attributing excessive erosion-reducing benefits to a particular cost-shared practice. USDA has advised us that the best available data are being used to compute variable-rate cost shares. (See USDA comments, p. 78.)

We believe that the variable-rate pilot project should be expanded as quickly as practicable to obtain a representative sample of all counties where the Universal Soil Loss and Wind Erosion Equations can be used. If test results are favorable, the variable-rate concept should be expanded programwide. Additionally, we believe the criterion for determining the federal cost-share rate should be changed from the current variable-rate criterion, which emphasizes reductions in soil movement relative to the T value, to one based on CRES-generated cost effectiveness data at the local level (in the short term) and on reductions in erosion's harmful effects (in the long term).

SCS should test the feasibility of variable-rate cost shares for its Great Plains Conservation Program

GPCP, which is applicable to the 10 Great Plains states, is similar in purpose and operation to ACP in that it tries to reduce erosion by encouraging voluntary, private sector participation and investment in conservation-related activities. The federal cost-share dollars under both programs are intended to promote conservation activities beyond those that farmers or ranchers would normally accomplish on their own.

According to SCS officials, nothing is innately peculiar to GPCP that would make it unfeasible or inappropriate to test a

funding concept similar to that of the ACP variable-rate cost-share pilot project. We believe that a variable-rate system should be tested for the GPCP and implemented programwide if test results are positive. In its July 6, 1983, comments on a draft of this report, USDA said that rule changes would be proposed to allow for such a test. (See p. 70.)

POTENTIAL CONSERVATION BENEFITS FROM REDUCED TILLAGE

An integral part of conventional tillage is the elimination or reduction of unwanted plants or plant residue by plowing a field. Plowing turns the earth over, burying the existing vegetation and exposing the bare soil. An undesirable side effect of conventional tillage is that the exposed soil is more susceptible to erosion. Conservation tillage methods, which leave appreciable crop residue on the land, decrease the amount and rate of water flow thereby reducing erosion. In 1981, an estimated 97 million acres of cropland were farmed with reduced tillage methods. Of this, about 9 million acres were farmed using the no-till method. About 5 percent ($8.5 million) of 1982 ACP funds was used to cost share the various forms of conservation tillage. Overall, farmers' use of these methods has been growing--from use on an estimated 29 million acres in 1973 to use on over 110 million acres in 1983.

Some USDA officials believe that soil erosion could be substantially reduced through more widespread use of reduced tillage farming methods, especially the no-till method. These methods can reduce erosion substantially even on highly erosive lands being intensively farmed. However, key USDA field staff have divergent views on using these methods. Some stress the use of no-till, while others believe that no-till presents too many uncertainties and risks and have been reluctant to promote its use.

Although top SCS officials strongly advocate reduced tillage use, they pointed out that it is not the total answer to solving all erosion problems. They said that reduced tillage farming can lead to effective erosion control when used as part of a system of conservation practices but that in certain areas, such as cooler northern regions and some wet areas, reduced tillage farming is still an unproven technique and continued research is needed to establish its advantages and/or disadvantages. Additionally, the officials said that they believe continued research was needed to further improve no-till use and capabilities in all areas. SCS' report on research needs (see app. V) lists conservation tillage research second among its highest priority needs. The report states that conservation tillage has the potential to reduce sheet and rill erosion by 50 to 90 percent but that its adoption is limited by four factors that require further study; namely,

--weed/pest problems,

--cold/wet soils,

--relatively few suitable crop varieties, and

--long-term effects on soil and water quality.

Expansion of reduced tillage techniques has been assisted, in some cases, by an aggressive selling approach by local USDA teams--SCS, ASCS, and Extension Service staffs. These teams have introduced reduced tillage through many different methods, such as presenting expert speakers and slide shows at group meetings and conducting demonstration field trips to show the practice in various stages of use. Because new skills and management techniques are required, SCS staff must work closely with each beginner. Some SCS field staff have arranged to provide farmers with necessary special equipment on a loan or rental basis for the experimental period.

ASCS has authorized cost-sharing funds as an incentive for farmers to experiment with conservation tillage--either reduced tillage systems or no-till systems. ASCS makes ACP payments to farmers for a maximum of 3 years in recognition that farmers will need some new equipment and will incur startup costs. However, some ASCS county committees have been reluctant to release ACP funds for reduced tillage because of apprehensions about the practice's effectiveness in certain situations or because some farmers are already using the practice without cost sharing. GPCP is now cost sharing conservation tillage practices.

Between 1976 and 1983, SCS increased its number of professional field agronomists from 53 to 119; all but one of the positions were established at the state and local level primarily to help train soil conservationists in conservation tillage methods and technology. SCS appointed a full-time national conservation tillage agronomist in 1981 and has issued revised conservation tillage standards to all states. ASCS has modified long-term agreement procedures to encourage conservation tillage. USDA said that, during the last 2 years, about $10 million was directed to ACP special projects that were primarily no-till or conservation-tillage oriented.

Of the 115 farmers we interviewed in the seven states we visited, 27 had tried or were using no-till farming. Reasons cited for nonuse often involved concerns that some SCS experts say have now been at least partially resolved, including problems relating to use of chemicals to control insects and weeds and doubts about sustaining crop yields and obtaining other claimed benefits.

In one state, ASCS officials generally limited conservation tillage payments to 10 farmers in each county and to 25 percent of the county allocation. In a county in another state, none of

the ASCS county committee members had tried no-till farming on their own farms and did not believe the time was right to push for it, so they limited no-till payments to a maximum of $100 per farmer. This county had a high erosion rate, and a local SCS official said that he believed no-till methods would be highly effective. No-till farming was used on about 35 farms in the county--mostly on an experimental basis on about 1,200 acres.

CONCLUSIONS

Notwithstanding USDA's need for better data on erosion's harmful effects so that conservation resources can be better focused on the most serious problems, we believe that everything possible should be done now to maximize program effectiveness even under the less-than-optimum data circumstances that exist. To this end, ASCS has cost/benefit data on some conservation practices in certain areas and is developing additional similar data (statistically valid at the local level) that can and should be used as a basis for conservation practice cost-share approval. Its pilot project of variable-rate cost sharing, coupled with CRES-generated cost/benefit considerations, holds excellent promise and should be expanded in ACP to ensure that a statistically valid sample is obtained. The variable-rate cost-share concept should also be tested for application in GPCP. CRES, when fully developed, will be a major source of information about the use of conservation resources. Local ASCS committees could use CRES-based cost/benefit data to more effectively distribute ACP cost-share funds. USDA national officials should use CRES data for program evaluations and resource allocation decisions.

The CRES data collection form needs to be modified so that "after" erosion data can be associated with individual ASCS conservation practices. If this is not practicable, then the erosion reduction data that are based on multiple practices should be identified as such and not be used to develop cost/benefit tables for individual conservation practices.

Also, the conservation potential of reduced tillage, especially no-till farming, should be further studied to more clearly establish its potential in various geographic and climatic situations and to improve its capabilities and results.

The USDA strategy of targeting "critical" erosion areas can, in some cases, favor highly eroding but relatively less productive land at the expense of fragile land that may be more productive but less erosive. Also, targeted money could be spent on deep, highly erosive lands that can tolerate erosion losses with little or no short- or mid-term impact on productivity at the expense of shallower soils that may erode at lower rates but suffer larger and more immediate productivity losses. USDA should proceed with caution in its targeting efforts until more is known about erosion/productivity relationships.

RECOMMENDATIONS TO THE SECRETARY OF AGRICULTURE

We recommend that, to maximize conservation benefits in the near term, the Secretary of Agriculture:

--Require that ASCS provide local ASCS committees with CRES-generated cost/benefit data, statistically significant at the local level, for all approved soil conservation cost-share practices as soon as these data become available and require that these data be used as a basis for future decisions on providing ASCS conservation assistance.

--Require that SCS test the feasibility of variable-rate cost sharing for its Great Plains Conservation Program.

--Require that SCS include in its report to the local ASCS committee, where applicable, a list of alternative practices that could effectively address an applicant's erosion problem.

--Expand the ASCS variable-rate cost-share pilot project as quickly as practicable to obtain a representative sample of all counties where the Universal Soil Loss and Wind Erosion Equations' formulas can be used; expand the variable-rate concept programwide if test results are favorable; and reorient resource allocation at the local level using CRES cost effectiveness as the short-term criterion and reductions in erosion's harmful effects as the long-term criterion.

--Reassess research priorities concerning conservation tillage to assure that allocated resources sufficiently address the needs identified in the January 1983 SCS research needs report.

--Revise CRES data analysis procedures to assure that the combined soil erosion reduction benefits of several conservation practices are not attributed to a single practice when conservation practice cost/benefit tables are developed.

AGENCY COMMENTS AND OUR EVALUATION

USDA generally agreed with the first three recommendations in this chapter. It said that (1) it will recommend that county committees use the CRES data as a primary source in conservation assistance decisions, (2) a revision of GPCP rules now in process would allow the system of variable-rate cost shares to be tested, and (3) a requirement for SCS to provide local ASCS committees with lists of alternative practices is in line with the intent of current procedures but that guidelines may need to be revised to place more emphasis on this requirement. (See app. VI.)

On expanding the variable-rate cost-share pilot project, USDA said that it intended to obtain a statistically valid sample of counties but believed that county participation should remain voluntary. Our concern is that the pilot project's voluntary aspect may delay or preclude USDA's obtaining a statistically valid sample--either nationally or locally. If this happens, programwide achievement of the promising benefits of this concept will be delayed or lost. We believe the pilot project should be expanded as quickly as practicable through whatever means (voluntary or mandatory) necessary.

Our draft report included a proposal directed at increasing the knowledge about conservation tillage's potential in varying geographic and climatic circumstances and promoting its use in advantageous situations. USDA included in its comments additional information describing its considerable efforts in promoting conservation tillage. This information has been added on pages 43 and 44. USDA agreed that reduced tillage is a desirable conservation farming method but did not discuss how its full potential is to be established in various geographic and climatic circumstances. The recommendation in this final report more clearly states our view that USDA should reassess research priorities to be assured that it adequately addresses the reduced-tillage research needs identified by SCS.

USDA interpreted one of our proposals in the draft report to mean that we were advocating that USDA deemphasize its multipractice systems approach to solving conservation problems in favor of a single-practice approach. This was not our intention, and the last recommendation in this chapter more clearly conveys that our major concern is with USDA's methodology used to obtain conservation practice cost-effectiveness data from the CRES program.

Our draft report also included a proposal that USDA use CRES data as a basis for program evaluation and resource allocation among the states. We are not including a recommendation on this matter in the final report because USDA has clarified that some use is being made of CRES data for evaluation purposes; that such use will be expanded; and that once statistically valid data become available, they will also be used to reassess conservation resource allocations.

CHAPTER 5

OTHER MATTERS

Other matters concerning USDA conservation programs include

--county committees' approval of applications for ACP funds without enough data to judge the relative merits of applications competing for limited funds;

--USDA's funding of ACP practices which may, in some instances, be primarily oriented toward such things as stimulating production or reducing normal farming costs rather than providing enduring erosion control and abatement; and

--evolution of GPCP to a multiobjective, ACP-like program.

QUESTIONS ABOUT SOME ACP COST-SHARED PRACTICES

In our February 1977 report (see p. 5), we said that USDA should give assistance priority to erosion control measures that provide critically needed, enduring soil conservation benefits and should seek out and offer assistance to farmers with the most severe erosion problems. In that report, we were critical that many of the funded practices were oriented more to increasing production than to reducing soil erosion. Some of the practices we cited are no longer being cost shared. For example, practices to install drainage systems for wet fields or to apply lime or other minerals to cropland are no longer eligible cost-shared practices. However, in some cases, the purpose of the federal assistance being provided at the time of our more recent review is still questionable.

Practices approved for cost sharing

ASCS officials have authorized an extensive list of practices for ACP cost sharing. For fiscal year 1982, 27 standard types of cost-sharing practices were authorized for national use, including 14 to abate soil loss, 8 to conserve water or improve its quality, and 5 to enhance forestry or wildlife. In addition, 30 special practices were authorized on the basis of requests from state or local officials citing needs for innovative practices or variations from standard practices to cope with unique problems.

Within the states we visited, ACP cost-sharing assistance is typically approved on a first-come-first-served basis despite ASCS instructions not to do so. Applicants select practices from the authorized list provided by the ASCS county committee. In many cases, an SCS technician visits the applicant's farm to assure that erosion or another conservation problem, in fact, exists and advises the committee whether the ACP practice is

technically sound and will reduce the problem. SCS technicians, however, do not systematically provide ASCS committees with professional judgments as to whether other practices would be more effective or less expensive or whether other areas of the farm or other farms in the county have more pressing problems that should be addressed first. Thus, although the ASCS county committee is the only entity that can reject an application, the committee may not have adequate evidence on which to evaluate a practice's relative merit or the merit of one application compared with others under review.

In developing their lists of authorized practices, some county committee offices we visited had restricted the practices they would approve for cost sharing--some limited cost sharing to several practices. In other cases, committees allowed nearly all practices on the state-approved list. In either case, once the county lists were established, the committees in some of the counties we visited generally did not try to set priorities or to channel funding into the most serious erosion areas or to use funds for the most effective practices. Although an applicant with an SCS-developed conservation farm plan would have already received the benefit of SCS professional advice as to that farm's conservation needs and priorities, the applicant is not obligated to strictly follow that advice since the practice need not be specifically included in the plan to be approved. Also, an applicant is not required to have an SCS-approved plan as a condition for receiving ACP cost sharing.

The ACP practices cost shared nationally in 1982 are listed in the table on the following page. Tables showing cost-shared practices in the 7 states and 15 counties where we made our review are in appendixes II and III, respectively.

ACP Cost-Shared Practices - Nationwide, 1982

Practice	ACP funds	Percent	Average Federal cost per acre
	(000 omitted)		
Soil conservation:			
Permanent vegetative cover establishment	$ 23,317	15	$ 32.66
Permanent vegetative cover improvement	21,379	14	12.37
Terrace	17,466	11	40.90
Grazing land protection	8,553	5	3.19
Cropland protective cover	6,931	4	6.22
No-till systems	6,052	4	13.72
Windbreak restoration/establishment	2,906	2	14.49
Diversions	3,411	2	27.72
Conservation tillage system	90	(a)	9.95
Permanent vegetative cover on critical areas	1,970	1	27.15
Stripcropping	1,863	1	14.93
Reduced tillage systems	2,343	1	8.27
Contour farming	188	(a)	7.70
Vegetative row barriers	3	(a)	2.70
Total	96,472	61	
Water conservation:			
Irrigation water conservation	$ 22,277	14	32.35
Water impoundment reservoirs	6,965	4	14.57
Ditches and dikes	121	(a)	14.96
Rangeland moisture conservation	13	(a)	3.12
Total	29,376	19	
Water pollution:			
Sod waterways	10,411	7	21.29
Sediment or water control structure	6,713	4	22.16
Animal waste control	5,531	4	2,264.15
Stream protection	172	(a)	22.06
Total	22,827	15	
Forestry	4,833	3	44.12
Wildlife	920	1	14.62
Total[b]	$154,428	100	

Note: Amounts may have minor differences because of rounding.

[a]Less than 1/2 percent.

[b]Thirty special practices account for the remaining dollar amount ($2,530,000) and about 1.6 percent of the regular and long-term agreement 1982 ACP funds. These special practices were requested by State or local officials who cited needs for variations of practices or innovative practices to address special problems, including such things as raising clod-form subsoil to prevent blowing, underground drainage systems, water management systems for pollution control, and forest fire and forest management access roads.

On a national basis as well as for the 7 states and 15 counties where we did our work, practices classified as soil conservation practices accounted for about 60 percent of ACP fiscal year 1982 cost-share funds; water-related practices accounted for about one fourth; and forestry, wildlife, and special practices accounted for the rest. Applications of some practices in the soil conservation category--such as terracing, reduced tillage, and contour farming--seemed to be directly related to abatement of soil loss. Applications of some other practices in this category, however, raised questions as to whether limited federal conservation resources are being spent for practices primarily oriented toward such things as stimulating agricultural production or reducing normal farm management costs, rather than providing enduring erosion control and abatement.

This was one of the major questions we raised in our 1977 report which ultimately resulted in a clear message in subsequent appropriation acts and in USDA policy which stipulated that conservation funds were to be used for enduring conservation measures and not for measures that are primarily production oriented. In 1979, ASCS eliminated a number of ACP practices considered to be oriented more toward production than conservation goals. However, some concerns remain.

Questionable application of some cost-shared practices

The local ASCS committee has a variety of cost-share practices at its disposal to attack local conservation problems. These practices are derived from a nationally authorized list, developed by ASCS. The states and, in turn, the counties either accept the list or pare it down to suit their individual needs. Application can also be made to supplement the authorized practices list with special practices to solve unique problems.

While all of the practices on the approved list may have legitimate conservation or environmental purposes, application of some of the practices in some instances could be deemed questionable when significant production benefits are derived. The following discussion highlights those practices where the conservation/production distinction may often be difficult to make.

About 40 percent of 1981 and 1982 ACP funds were used for cost sharing the practices shown in the table on the following page.

Practice	1981 Dollars	1981 Percent	1982 Dollars	1982 Percent
	(000 omitted)		(000 omitted)	
Permanent vegetative cover establishment	$25,634	14	$23,317	15
Permanent vegetative cover improvement	24,697	14	21,379	14
Cropland protective cover	8,669	5	6,931	4
Permanent vegetative cover on critical areas	2,334	1	1,970	1
Grazing land protection	11,635	6	8,553	5
Total	$72,969	40	$62,150	39

Cost-sharing payments for the establishment of permanent vegetative cover may be used for seed, fertilizer, and lime applications to stimulate vegetative growth. This practice can be particularly effective in reducing erosion when the land is unsuitable for cropping because it is too erosive. ASCS' January 1981 ACP evaluation report (see p. 27) showed, however, that in more than half the cases checked, the land was not particularly erosive.

Of the 115 farmers we interviewed, 36 had received cost sharing for this practice. Eight of them acknowledged that the practice resulted mainly in increased production of forage crops or was part of a normal crop rotation system. In one county we visited, the vegetative cover that was cost shared had a limited productive lifespan and was better suited for forage production than for permanent protective cover.

To qualify for cost-sharing payments, producers must agree to keep the established vegetative cover for at least 5 years but are then free to return the land to crop production or other uses. A state ACP official told us that a 5-year rotation of land from hay or forage production to cropping often is a normal farming practice. Where this is the case, cost sharing of vegetative cover is being used merely to defray normal operating costs. This also may be the case when cost sharing is approved to improve or protect an existing cropland cover.

Cost sharing to extend the life of an existing permanent vegetative cover is authorized by USDA to protect soil from erosion. This practice includes such things as reseeding, applying minerals such as lime or fertilizer, and controlling competitive shrubs. Puerto Rico, the Virgin Islands, and nine states used 25 percent or more of their 1981 ACP cost-sharing funds for this practice. In West Virginia, $1.8 million, or about 80 percent of all available cost-sharing funds, was spent on this practice mainly to improve cover on pastureland grazed by cattle and sheep, and county offices typically have waiting lists of applicants.

To qualify for cost sharing of this practice, an applicant is required to substantiate the need for fertilizers or lime. The presence of such minerals in the soil diminishes because of normal farming operations; replenishment, therefore, is a normal, periodic operating requirement to restore the farming unit's productivity.

Although improving permanent vegetative cover has been very popular--all 50 states cost shared the practice in 1981--cost-share money used to enhance hay or forage production or to supplant what a farmer normally does and should continue to do as part of a farming operation seems highly questionable. Cost sharing for fertilizer and lime applications on cropland was discontinued as a separate practice because this resulted in significant increased productivity and the costs were part of normal farming operations. We believe similar reasons exist for questioning the cost sharing of fertilizer and lime applications to improve vegetative cover for forage purposes or on land not permanently retired from cropping. Some ASCS officials told us that they believed cost sharing of permanent vegetative cover improvement may not be appropriate for the same reasons.

The grazing land protection practice protects vegetative cover by increasing water supplies or creating a better distribution or rotation of animal grazing. Cost-share activities include constructing or deepening wells; developing springs; constructing dams and ponds; and installing pipelines, water storage facilities, and fences.

If a section of range, for example, has a water supply in only one corner, cattle tend to concentrate their grazing in or near that area. In doing so, they may overgraze the area near the water and expose the soil to the erosive action of wind and water. When new water supplies are added or fences are erected, the cattle can graze more evenly.

Of the 115 farmers we interviewed, 8 had received cost sharing (ACP or GPCP) for installing pipelines, 6 for wells, and 3 for fencing. These farmers said that the practices were installed to provide stockwater and for better use of grazing land.

The stated purpose of this practice is to protect vegetative cover so as to reduce soil erosion and pollution. However, although the practice can do this, a primary focus seems to be better management of grazing resources--which ought to be a basic production-oriented farm responsibility. Use of limited cost-sharing assistance for this practice for production-oriented purposes seems questionable.

Applications of some approved ACP practices having objectives other than soil conservation (such as conserving water and reducing water pollution) in some cases have questionable effectiveness in meeting those objectives but are very popular because they increase farm productivity and/or reduce normal farm work and operating costs. In our 1977 report, we discussed cost-shared practices that appeared to have a sufficiently high economic return to provide an incentive for farmers to install with their own resources. The reasons for our concerns were discussed in detail in that report and are not fully repeated here. Of particular concern in our 1977 report were practices relating to improvement of irrigation systems.

Nationally, about 14 percent of 1982 ACP funds went for irrigation water conservation. This practice involves lining irrigation ditches with concrete to prevent seepage, leveling land to permit even distribution of water over an entire field, or constructing water recovery systems that allow reuse of irrigation water.

In some cases, this practice results in reduced water consumption and can save water either for subsequent use or for use by others such as municipalities or industry. In other cases, however, the installed practice achieves more efficient use of water but little or no actual conservation. In one county we visited, for example, farmers generally continued to receive the same quantities of water after the practice was installed as before. By improving irrigation efficiency, however, the farmers were sometimes able to increase production yields and/or reduce normal operating and maintenance expenses. Also, once an irrigation system is significantly improved, the land generally becomes more valuable.

An ASCS official told us that where no major conservation occurred and where operators were directly benefited economically by increased productivity and land values and by reduced operating and maintenance costs, cost sharing of this practice was questionable.

In 1982, 7 percent of ACP funds was spent on sod waterways. These waterways are designed for the safe removal of surplus water from cropland and can be either natural or constructed waterways or outlets shaped or graded and planted with suitable vegetation. Constructing a waterway usually involves using heavy equipment to fill in and repair ditches caused by erosion and planting a vegetative cover to prevent recurrence.

Although not classified as a soil conservation practice, sod waterways decrease topsoil erosion by preventing washing of the soil, and they are especially valuable when concentrated waterflows occur after rainfalls. An SCS official told us, however, that for such waterways to be effective, farmers need to use soil conservation practices such as terraces or no-till farming on the watershed feeding into the waterway or the area will fill with sediment.

ACP cost sharing for sod waterways has been widespread and major. In 17 counties in two states we visited, sod waterways constituted the dominant practice being cost shared. In one county, for example, 76 percent, or $92,000, of 1981 cost-sharing funds was spent to construct sod waterways on 72 farms. Of the eight farmers we interviewed in this county, six had received cost sharing to install eight waterways.

Only 16 farms in this county had benefited from cost sharing of any other practice in 1981. In 1981 at least four farmers in the county who had applied for cost sharing to begin no-till farming (considered by many to be a highly effective soil conservation practice as discussed in ch. 4) were turned down because available 1981 funds had been used for waterways.

One reason cost sharing for waterways is so popular is that, when completed, a waterway often facilitates a farmer's field work. Ditches and gullies in a field can obstruct use of field equipment. But once the waterway is in place, field equipment can move about more easily, thereby reducing the farmer's time and expense.

EVOLUTION OF GPCP TO A MULTIOBJECTIVE, ACP-LIKE PROGRAM

GPCP's present focus and overall results are quite different from those envisioned by USDA when the program was established in 1956. Its early legislative history emphasized the critical need for converting unsuitable Great Plains cropland to permanent vegetative cover and reseeding badly depleted rangeland by 1971--later changed to 1981 and then to 1991. About 16 million of the 18 million acres of such land were to be so treated under the program, and about 95 percent of the program's funds was to be used for this purpose. This seemed consistent with the original legislative intention that GPCP be a special program to counter the unique climatic conditions of the Great Plains in counties susceptible to serious wind erosion. In subsequent years, however, GPCP has legislatively and operationally evolved into a multiobjective program, cost sharing 36 types of practices--similar to the ACP. As of 1982, 5.8 million acres had been converted or reseeded.

Our 1973 report (B-114833, June 28, 1973) and our 1977 report (see p. 5) which discuss USDA's progress in meeting important objectives of GPCP show the general decline in the

proportion of program funds used to provide or improve vegetative cover on the land--and this decline has continued.

It is not clear how many of the 5.8 million acres were part of the 16 million acres originally planned for treatment because additional counties have been brought into the program. As of 1972, 469 counties had been approved for program coverage; by September 1982 the number had increased to 519. Also, grassland acres are continually being converted to cropland and cropland acres to grassland. For example, during 1975-80, 960,000 acres of South Dakota cropland were converted to grassland and 1,651,000 acres of grassland were converted to cropland.

The following table shows the types of practices for which GPCP funds were spent during the 3 years ended fiscal year 1982 and cumulative through that year:

Practice category	Fiscal years 1980-82		Cumulative, fiscal years 1956-82	
	Cost	Percent	Cost	Percent
	(millions)		(millions)	
Vegetative cover (including establishing permanent vegetative cover and reestablishing grasslands)	$10.4	23	$ 68.4	26
Grazing management (including developing wells, springs, and seeps; constructing dams, ponds, pipelines, and fences; and controlling competitive shrubs)	15.9	35	89.6	34
Irrigation (including reorganizing systems; leveling land; constructing dams, pits, and ponds; lining ditches, canals, etc.; and constructing water recovery systems)	2.5	5	22.7	9
Terraces	6.7	15	35.8	14
Permanent waterways	1.2	3	8.5	3
Other	8.4	19	38.1	14
Total	$45.2	100	$263.1	100

Both GPCP states we visited had backlogs of requests for federal assistance, but most of the money was going for practices other than vegetative cover--and they were often more expensive. For example, we noted one application that involved $33,739 for constructing a well, pipeline, dam, and water storage facility on a 3,000-acre farm, which will enable a more even grazing of the land. The well alone will cost $18,175.

Regarding the vegetative cover practice, however, and in line with the concern noted earlier in this chapter regarding ACP, we believe that no explicit safeguards are in place to assure that GPCP vegetative cover practices are primarily providing enduring erosion control and abatement as opposed to being part of a normal crop rotation or increasing production of hay or forage crops.

CONCLUSIONS

A number of questions remain as to whether limited conservation funds are being wisely spent. We recognize that various "gray areas" exist where the primary aim of a practice (conservation or production) may be difficult to judge. We believe, however, that specific and detailed guidance should be provided to state and local program officials as to what kinds of situations would or would not be in compliance with legislation and USDA policy which state that federal financial conservation assistance should not be used primarily to enhance farm production or defray normal operating costs, but rather should be used to provide critically needed, enduring conservation benefits. Coupled with such guidance should be a requirement that officials approving financial assistance certify that, on the basis of available information, such assistance is in compliance with law and policy in this regard.

RECOMMENDATION TO THE SECRETARY OF AGRICULTURE

We recommend that the Secretary of Agriculture require that specific and detailed guidance, coupled with assistance approval certifications, as discussed above, be established and used at all state and local levels. This guidance should ensure that the government does not cost share practices primarily used to enhance production or defray costs that are, or should be, part of normal farming or ranching operations, rather than to provide enduring conservation benefits.

AGENCY COMMENTS AND OUR EVALUATION

USDA said that it has been emphasizing that the practices being cost shared must primarily provide enduring conservation benefits. (See app. VI.) It expressed concern that (1) too much emphasis was placed on vegetative cover in our discussions

of the GPCP program and (2) not enough emphasis was given to USDA's water conservation responsibilities in our discussions of irrigation systems.

Our discussion of the GPCP was intended to update information presented in our two earlier reports that discussed this program (see p. 55) and to show that the thrust of GPCP practices is generally similar to that of ACP practices. We made some modifications in our report presentation to make this intention clearer.

Regarding the need to take into account USDA's overall conservation objectives, we recognize that water conservation is a major program responsibility and do not take issue with the need for USDA to pursue this goal. However, as in our discussions on the application of soil conservation practices, we question whether some of the applications of water conservation practices result in limited federal conservation resources being used to provide benefits primarily oriented to stimulating agricultural production or reducing normal farm management costs, rather than to conserving water.

APPENDIX I

AGRICULTURAL CONSERVATION PROGRAM OBLIGATIONS AND OUTLAYS BY STATE, FISCAL YEAR 1982

State	Obligation	Outlay
Alabama	$ 5,243,594	$ 4,534,743
Alaska	66,932	159,364
Arizona	1,785,868	1,654,221
Arkansas	3,572,413	3,377,068
California	4,785,179	4,540,086
Colorado	5,147,606	5,341,066
Connecticut	505,617	432,926
Delaware	191,977	217,775
Florida	3,836,618	3,513,306
Georgia	5,717,309	4,740,662
Hawaii	526,195	465,092
Idaho	3,893,635	2,504,657
Illinois	6,095,289	6,209,041
Indiana	3,965,337	3,681,318
Iowa	7,353,317	6,201,763
Kansas	5,589,498	4,594,530
Kentucky	5,014,096	4,350,251
Louisiana	3,727,928	3,137,498
Maine	2,453,742	1,801,744
Maryland	892,375	912,208
Massachusetts	672,583	483,206
Michigan	4,295,070	4,316,216
Minnesota	5,868,370	5,581,780
Mississippi	4,965,500	4,331,438
Missouri	7,518,105	5,911,776
Montana	4,376,448	3,832,935
Nebraska	4,289,833	3,952,588
Nevada	976,440	759,139
New Hampshire	633,718	588,026
New Jersey	601,110	532,586
New Mexico	2,219,219	2,537,188
New York	4,330,081	4,325,775
North Carolina	4,165,564	3,913,900
North Dakota	2,517,907	2,652,057
Ohio	4,048,870	4,445,654
Oklahoma	4,488,024	3,939,340
Oregon	3,995,009	3,182,875
Pennsylvania	4,514,576	4,110,394
Puerto Rico	663,711	607,131
Rhode Island	105,465	115,444
South Carolina	2,796,876	2,693,688
South Dakota	2,947,807	2,533,868
Tennessee	4,992,904	4,268,551
Texas	17,014,021	14,779,465
Utah	4,071,952	3,302,842
Vermont	1,052,049	1,024,973
Virginia	3,173,044	2,671,162
Virgin Islands	20,960	22,930
Washington	4,922,173	4,257,843
West Virginia	1,575,034	1,719,762
Wisconsin	4,748,783	4,648,551
Wyoming	1,840,725	1,444,098
Undistributed	-474,323	-42,762
Total ASCS (includes SCS tech. assistance)	184,292,133	165,813,737
Forest Service technical assistance	1,481,821	2,014,439
Total program	$185,773,954	$167,828,176

APPENDIX II

ACP COST-SHARED PRACTICES

FOR SEVEN SELECTED STATES, 1982

Practice	ACP funds	Percent
	(000 omitted)	
Soil conservation:		
Perm. veg. cover establishment	$ 3,461	11
Perm. veg. cover improvement	1,537	5
Terrace	9,263	29
Grazing land protection	1,104	3
Cropland protective cover	180	1
No-till systems	1,995	6
Windbreak restoration/estab.	1,615	5
Diversions	667	2
Conservation tillage systems	2	(b)
Perm. veg. cover on critical areas	156	(b)
Stripcropping	315	1
Reduced tillage systems	931	3
Contour farming	117	(b)
Vegetative row barriers	(a)	(b)
Total	21,344	66
Water conservation:		
Irrigation water conserv.	1,465	5
Water impound. reservoirs	1,443	5
Ditches and dikes	5	(b)
Rangeland moisture conserv.	4	(b)
Total	2,917	9
Water pollution:		
Sod waterways	3,299	10
Sediment or water control struc.	1,758	5
Animal waste control	1,076	3
Stream protection	26	(b)
Total	6,159	19
Forestry	1,013	3
Wildlife	426	1
Special projects	274	1
Total	$32,133	100

Note: Totals may not add because of rounding.

[a]Less than $500.

[b]Less than 1/2 percent.

APPENDIX III

ACP COST-SHARED PRACTICES

FOR 15 SELECTED COUNTIES, 1982

	ACP funds	Percent
	(000 omitted)	
Soil conservation:		
Perm. veg. cover estab.	$ 164	13
Perm. veg. cover improv.	23	2
Terrace	180	14
Grazing land protection	18	1
Cropland protective cover	2	(b)
No-till systems	224	17
Windbreak restor./estab.	20	2
Diversions	49	4
Conserv. tillage system	0	0
Perm. veg. cover on critical areas	17	1
Stripcropping	62	5
Reduced tillage systems	37	3
Contour farming	(a)	(b)
Total	796	63
Water conservation:		
Irrigation water conserv.	4	(b)
Water impound. reservoirs	46	4
Total	50	4
Water pollution:		
Sod waterways	138	11
Sediment or water contr. struc.	66	5
Animal waste control	50	4
Stream protection	4	(b)
Total	258	20
Forestry	101	8
Wildlife	5	(a)
Special projects	52	4
Total	$1,262	100

Note: Amounts may have minor differences because of rounding.

[a]Less than $500.

[b]Less than 1/2 percent.

CONSERVATION OPERATIONS PROGRAM--TECHNICAL ASSISTANCE

FY 1983 STATE ALLOCATIONS

State	Nontargeted funds	Targeted funds	Total funds
	(millions)		
Alabama	$ 4,898	$ 673	$ 5,571
Alaska	655	0	655
Arizona	2,704	0	2,704
Arkansas	5,429	350	5,779
California	7,561	600	8,161
Colorado	6,377	425	6,802
Connecticut	803	0	803
Delaware	486	0	486
Florida	3,464	100	3,564
Georgia	6,083	530	6,613
Hawaii	1,301	0	1,301
Idaho	3,569	507	4,076
Illinois	6,294	250	6,544
Indiana	5,661	300	5,961
Iowa	6,548	1,301	7,849
Kansas	7,097	400	7,497
Kentucky	5,365	395	5,760
Louisiana	3,781	250	4,031
Maine	1,161	125	1,286
Maryland	1,880	0	1,880
Massachusetts	1,099	0	1,099
Michigan	4,499	0	4,499
Minnesota	5,407	225	5,632
Mississippi	5,153	228	5,381
Missouri	6,484	734	7,218
Montana	4,182	163	4,345
Nebraska	5,893	700	6,593
Nevada	1,415	134	1,549
New Hampshire	929	0	929
New Jersey	1,225	0	1,225
New Mexico	4,457	75	4,532
New York	4,309	0	4,309
North Carolina	5,500	300	5,800
North Dakota	3,929	0	3,929
Ohio	5,323	0	5,323
Oklahoma	6,822	225	7,047
Oregon	3,823	340	4,163
Pennsylvania	4,119	0	4,119
Puerto Rico	1,775	0	1,775
Rhode Island	296	0	296
South Carolina	3,451	0	3,451
South Dakota	3,781	0	3,781
Tennessee	5,048	900	5,948
Texas	18,968	525	19,493
Utah	2,977	246	3,233
Vermont	1,181	0	1,181
Virginia	3,950	300	4,250
Washington	4,777	837	5,614
West Virginia	2,999	0	2,999
Wisconsin	4,266	200	4,466
Wyoming	2,999	162	3,160
Total	$212,153	$12,500	$224,653

HIGHEST PRIORITY NEEDS[1]

RESEARCH NEED NO. 1

Need: Research on Erosion-Soil Productivity Relationships

Statement of Problem: Program planning and budget decisions are being made in the absence of scientifically defensible information regarding the quantitative effects of erosion on soil productivity. As a result, agencies administering soil conservation programs may not be directing an appropriate portion of limited resources to those areas where erosion is having the greatest effect on long-term soil productivity.

Extent of Problem: The problem is nationwide.

Specific Information Needed: A mathematical model for use in determining the relationship between erosion and soil productivity has been developed by ARS and the Economic Research Service. This model, called EPIC (Erosion-Productivity Impact Calculator), appears to be a potentially useful tool. Needed now are:

a. Crop yield data for noneroded and eroded conditions on a wide range of benchmark soils, in the major land resource areas, for all principal crops, and for specified levels of soil management. These are needed to calibrate the model and to provide accurate coefficients for the pertinent factors. This work needs to be coordinated to ensure that the research will provide data needed to operate the model.

b. Improvements in soil loss prediction for those areas where adequate factor values are not available for the Universal Soil Loss Equation.

c. Long-term economic aspects of the effects of erosion on soil productivity, in quantitative terms. Include values of nutrients lost.

Existing Technology: At present, decisions are based on soil loss as expressed by the USLE. The EPIC model cannot be used effectively until the needs expressed above are met. An area-specific model, developed by ARS at the University of Minnesota,

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[1]Soil Conservation Service, Excerpt from "Soil and Water Conservation Research and Education Progress and Needs," Jan. 1983.

uses data from the SCS Soils-5 file. This model could serve in the interim for the principal crop-producing areas.

Risks Associated With Using Existing Technology: The greatest risk is that future productivity of some of the Nation's important soils may be permanently impaired by lack of attention in soil conservation program planning and budgeting. Another, more immediate, concern is that severely limited Federal and State resources may be inadvertently misdirected and thus wasted.

Potential Users:

a. Farmers.
b. Conservation districts and other local organizations and agencies.
c. State agencies.
d. SCS, ASCS, ES, Farmers Home Administration, and other Federal agencies.
e. Congress.

Suggested Locations for Research: Field measurements are needed on benchmark soils in important crop-producing areas throughout the Nation. Continued refinement of the EPIC model should be continued at Temple, Texas.

RESEARCH NEED NO. 2

Need: Conservation Tillage Research

Statement of Problem: Although conservation tillage is very effective in reducing soil erosion, adoption in many areas is limited because of one or more of the following:

a. Weed and/or other pest problems, e.g.,
   - o Blacklands (Texas)--Johnson grass.
   - o Palouse (Idaho, Oregon, Washington)--wild oats, cheat grass, and rodents.
   - o Southeast--Johnson grass, Texas panicum, and sicklepod.
   - o Northern Cornbelt--quack grass, velvet leaf, and foxtail.
b. Inherently 'cold' and/or 'wet' soils and other climate-related conditions.
c. Lack of crop varieties suited to conservation tillage.
d. In addition, as the use of conservation tillage has increased, questions have been raised regarding the long-term effects of this practice on soil and water quality.

Extent of Problem: The problem in one or more of its manifestations exists nationwide.

APPENDIX V

Specific Information Needed: For each major problem area,

a. Vulnerability of weeds and other pests to control methods such as chemicals, cultural practices, equipment, and integrated pest management techniques are needed for the predominant cropping patterns in the major agricultural ecosystems that are subject to excessive soil erosion.
b. Conservation tillage systems that perform successfully under adverse climatic or soil conditions, including soil wetness, and considering soil compaction.
c. Crop cultivars which yield well under conservation tillage.
d. Methods of including legumes in conservation tillage systems for nitrogen fixation, soil fertility, and soil cover.
e. Data on the pathways and fate of nutrients and pesticides (in surface and ground water) associated with conservation tillage systems, including an evaluation of human health and other environmental effects.

All of the above research must give due consideration to crop nutrient management. Also, economic costs and benefits should be included in evaluations of conservation tillage systems.

Existing Technology: Considerable progress has taken place in the area of weed control, although severe problems still exist as noted above. Some information has been developed for overcoming cold and wet soil limitations, and on varietal selection for conservation tillage, but much more is needed.

Risks Associated With Using Existing Technology: Until the technology is sufficiently improved to ensure widespread adoption of conservation tillage, more expensive soil conservation practices will be necessary or accelerated erosion will continue on more than 50 million acres of cropland. Research and field experience indicate conservation tillage, including reduced tillage, has the potential to reduce sheet and rill erosion by 50-90 percent depending on the type of system used and the susceptibility of specific soils to erosion.

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

JUL - 6 1983

Mr. J. Dexter Peach
Director, Resources, Community and
Economic Development Division
United States General
Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

This is in response to Mr. Donn E. Adkisson's request for comments on the Draft Report "Department of Agriculture Soil Conservation Programs Are Not Realizing Their Full Potential In The War Against Soil Erosion."

The Department of Agriculture (USDA) agrees with the basic thrust and most of the conclusions of the report. Overall, the report is objective and proposes progressive actions, with one major exception, which support current USDA concepts for future program direction. Several of the actions proposed are already underway, and in some cases, are farther along than the report indicates.

We perceive the central or primary theme of the report is basically that future allocation of resources at the national, State, and local levels should be based upon the value of damage caused by soil erosion, i.e., should give priority to areas where soil erosion is causing the most damage and to treatment that reduces the damage at the least cost. That theme is consistent with the National Program for Soil and Water Conservation that was transmitted to the Congress by President Reagan in December 1982, in response to the Resources Conservation Act. In the development of that program, USDA identified several actions that needed to be undertaken to improve the basis for program management. One of those actions was to initiate the development of the tools necessary to quantify onsite and offsite damages associated with the application of conservation systems. Using existing techniques, quantifying onsite and offsite damages on a case-by-case basis with any degree of reliability and accuracy is very costly.

For the most part, USDA has in the past used the assumption that the damages are likely to be greatest where either the erosion rates are highest, or total soil loss is greatest, or both. Recent efforts have been increasingly directed to areas where erosion is thought to be most seriously reducing the potential to produce food and fiber in the future. Our earlier assumption is rightfully questioned in the report, and we support the need for more research to study these relationships.

GAO note: Page and paragraph references in this letter have been changed to correspond to those in the final report. Also, some recommendation numbers used by USDA have been revised because of changes made in finalizing the report.

APPENDIX VI

We question the statements in the support material throughout the report that seem to imply a large acreage of productive fragile land is being or is in danger of being overlooked in our present allocation methods. Although we agree with the concern and the conclusions, we apparently differ on the magnitude of the threat and feel too much weight is given to this issue in the report.

[GAO COMMENT: The enclosure to USDA's letter (see p. 74) cites statements on pages iii, 22, 34, 39, and 45 as being the material in question. The main point we are making in this regard is that, to gain the maximum economic benefit for each soil conservation dollar spent, soil conservation resource allocations should be based on minimizing erosion's harmful effects (onsite and offsite) and not on amounts of soil displaced. We do not mean to imply that "a large acreage of productive fragile land is being or is in danger of being overlooked." We do not know how much land may fall into this category. Under USDA's allocation/targeting systems, however, areas with lower erosion rates can have a lower funding priority. To the extent that these are highly productive areas with soils that are "fragile," USDA's priorities in allocating soil conservation resources, may be overlooking aras where the productive capacity of the nation's soils could be unnecessarily diminished. The paragraph on pages 22 and 23 has been added to clarify this point.]

The major exception alluded to in our opening paragraph relates to collecting data on individual practices. In a report that is quite progressive, what appears to be a suggested reversion to a practice-by-practice basis for collection of data stands out as a major inconsistency. We have clearly demonstrated the concept that the systems approach to solving conservation problems is more effective and efficient than single practice efforts. Too often application of a single practice makes ineffective use of technical and financial assistance unless supporting management and/or complementary practices are applied in combination with the practice requested. The development of the Conservation Reporting and Evaluation System (CRES) has aided the movement to implement the systems approach to solving conservation problems. USDA feels strongly that to return to a focus on single practices would be a step backward in accomplishing cost-effective soil conservation.

[GAO COMMENT: We are not suggesting that USDA revert to single-practice applications and we support USDA's efforts to establish a systems approach for applying conservation practices to combat soil erosion. The issue we raise is not with the systems application of practices but with how the cost effectiveness of those practices is to be measured. As discussed on pages 44 and 46, and in our revised recommendation on page 46, we are concerned that USDA's methodology for developing practice cost-effectiveness data may hinder its efforts to obtain meaningful data like that presented on page 38 of this report.]

APPENDIX VI

Of general concern is the tendency of the General Accounting Office (GAO) to limit audits to a single conservation objective when the USDA Soil and Water Conservation Program is a blend of multiple objectives. This report has made an extra effort to point out that control of soil erosion is only one of the conservation objectives of USDA. Once mentioned, however, the "other" objectives seem to be forgotten or overlooked. We would direct your attention to table 3, page 32, of the National Program for Soil and Water Conservation for a more complete understanding of how USDA plans to relate priorities among competing resource problem concerns, and the distribution of USDA funds and personnel to deal with those concerns. We feel the table clearly shows that erosion control is not the single soil and water conservation objective of USDA.

[GAO COMMENT: As USDA mentions, we have tried to emphasize USDA's multiple resource conservation responsibilities, even though our review focused on USDA's highest conservation priority--excessive soil erosion. (See pp. i, 2, 3, 23, 29, 33, 48, and 54.) Without trying to minimize the importance of the other program objectives, we make the point that the wide range of such different objectives makes it particularly important that maximum effectiveness be obtained from the resources available to address soil erosion problems--USDA's first conservation priority. The table USDA refers to is reproduced below.]

Resource concern	National Priority	Distribution of funding	
		FY 1981	Fifth-year projection
		(Percent)	(Percent)
Reduce soil erosion on crop, pasture, range, and forest lands.	1	30.5	38
Conserve water in the management of crop, pasture, range, and forest lands.	2	10.7	13
Reduce upstream flood damages.	2	13.1	16
Improve pasture, range, and forest lands.	*		
Improve water quality.	*		
Conserve rural community and urban resources.	*	45.7	33
Improve fish and wildlife habitat.	*		
Conserve energy.	*		
Improve organic waste management.	*		
Total		100.0	100

*Note: Priorities for these national concerns will be established at the local and state levels.

The following comments on the individual recommendations at the end of Chapters 3, 4, and 5 of the Draft Report are offered:

[GAO COMMENT: USDA did not address the chapter 2 recommendation in this letter but, in a subsequent discussion, USDA's Agricultural Research Service said that it agreed with and supported our conclusions and recommendation.]

CHAPTER 3

Recommendation 1

USDA agrees with the GAO finding that both onsite and offsite effects are essential for efficient and effective resource allocation. CRES represents the leading edge of the state-of-the-art at the field level of qualifying onsite practice impacts. Offsite impacts are being pursued (as rapidly as research can develop procedures) through pilot projects and will be incorporated as soon as field techniques are available.

Recommendation 2

USDA agrees with this recommendation. The Agricultural Stabilization and Conservation Service (ASCS) and the Soil Conservation Service (SCS) are moving toward allocation of conservation funds used for erosion control based on the effects of erosion as rapidly as the tools for doing so become available on a nationally consistent basis.

CHAPTER 4

Recommendation 1

This recommendation is consistent with USDA objectives. The CRES design includes the capability of providing cost and effects data significant at the county level specifically for the purpose of aiding county office committees (COC's) in allocating funds. ASCS will recommend this be used by the COC's as a primary source of information for decisions on conservation assistance.

Recommendation

USDA feels this recommendation could be dropped. It seems to imply that none of these actions have been considered. ASCS is already using CRES generated cost-benefit data to evaluate conservation program operations. As data becomes available from all counties, CRES will be used extensively to evaluate State and local programs.

Approximately 1,200 counties are currently reporting conservation activity through CRES. As of October 1, 1983, every county in the nation will be using the system. Once these data are statistically valid to the State level and are matched to the resource needs as determined by the 1982 National Resource Inventory, resource allocations can and will be reassessed.

[GAO COMMENT: Our draft report included a proposal that national level officials use CRES-generated cost/benefit data to evaluate State and local programs; recommend changes; and, if necessary, reapportion resource allocations among the States. During our review, USDA officials said that national-level officials were not planning to use CRES data for these purposes. Because this is not the current USDA position, our discussion, conclusion, and proposal on this matter are not included in our report.]

Since 1978, ASCS has been reapportioning funds among the States to be used for special projects such as water quality, small farms, conservation tillage, etc. Also, since 1982, additional funds have been targeted to critical soil erosion and water short areas.

[GAO COMMENT: This information is not germane to the CRES data/reapportionment issue because the fund redistributions and targeting were not based on CRES-generated cost/benefit data.]

Recommendation 2

ASCS has been closely monitoring the Pilot Variable Cost-Share Level Program (VC/SL) since its inception in 1981 to determine whether or not VC/SL is a viable method of cost-sharing. So far VC/SL looks promising in areas where the Universal Soil Loss Equation (USLE) and Wind Erosion Equation can be used with a reasonable degree of accuracy. It is the intention of ASCS to expand VC/SL to include sufficient counties for a statistically valid sample, other types of erosion, and other types of conservation as technology and legislative authority permits. However, we strongly believe the program should continue as a pilot, and that participation by counties continue to be on a volunteer basis.

[GAO COMMENT: Although ASCS intends to obtain enough county participation in its pilot program for a statistically valid sample, the program's voluntary nature may delay or preclude the agency from reaching that goal and achieving the promising benefits of this concept programwide. We believe the pilot program should be expanded as quickly as practicable through whatever means (voluntary or mandatory) necessary.]

Recommendation 3

Current Great Plains Conservation Program (GPCP) rules and regulations do not provide latitude for testing feasibility of variable cost-share rates within the program. These rules are in the process of being revised and will be published as proposed rules soon. If finalized as proposed, the SCS can test variable cost-share in trial counties in selected GPCP States. Other bases for determining cost-share rates are being considered which would more nearly reflect the multiple objectives of the GPCP.

Recommendation 4

SCS feels listing alternative practices is in line with the intent of current procedures which state, "...after investigating need and feasibility, provide findings to the ASCS county committee on RE-247. Provide the committee all technical observations of site conditions and participant activity that may effect eligibility determination." Current procedural guidelines may need to be revised to place more emphasis on including the alternative treatment that could also correct the problem adequately at less cost.

This response assumes that such an entry would be needed and made only when the alternative is compatible with the ongoing or planned cropping system, is considered to be more cost-effective, and the land user has opted to carry out the treatment alternative that is considered less cost-effective after the alternatives were discussed with him by SCS.

Recommendation 5

ASCS and SCS agree that reduced tillage is a desirable conservation method of farming and should be aggressively promoted. Considerable SCS emphasis has been and continues to be placed on all types of conservation tillage farming. SCS feels this effort has contributed significantly to the 279 percent increase, from 29 million acres to 110 million acres, in conservation tillage since 1973. SCS has increased the number of professional field agronomists by 120 percent to help train soil conservationists in conservation tillage. A national conservation tillage agronomist was appointed in 1981 who works full-time on conservation tillage. SCS has issued revised standards for conservation tillage to all States. Local technical guides have all been updated to include specifications for implementing reduced tillage practices, including no-till. GPCP is now cost-sharing for conservation tillage.

ASCS has also taken positive actions to promote no-till and conservation tillage. The Long-Term Agreements procedure for county committees has been altered to encourage the use of conservation tillage and to include no-till in the agreements. During the past 2 years, approximately $10 million of the Agricultural Conservation Program (ACP) funds were directed to special projects which were primarily no-till and conservation tillage. Most of the States have had at least one project.

[GAO COMMENT: We recognize in the report that there has been expansion of conservation tillage in the United States. However, as identified in the SCS report on research needs (see app. V), four factors limit broader use of this practice and require further study. The last paragraph on page 43 and our recommendation have been revised to more clearly address that need.]

Recommendation 6

USDA is concerned by this recommendation to modify data collection methods. As indicated in the general comments, it appears that by suggesting practice-by-practice data collection, GAO seems to be recommending reversion to a single practice approach to solving conservation problems. If this is so, we cannot agree with the recommendation, since experience has clearly demonstrated the superior efficiency and effectiveness of the systems approach.

USDA hopes the report would concur with and support a systems approach to solving erosion problems, as opposed to the single practice methods which have proven less successful. As indicated by the USLE, erosion can more effectively be controlled by several combinations of conservation practices and management practices, while any one practice alone is normally not adequate. The annual erosion reduction resulting from a system often cannot be attributed accurately to the individual components of a system. Also, the results of installing a system of practices may be greater than the sum of the results obtained from each individual component.

[GAO COMMENT: We are not recommending "reversion to a single practice approach to solving conservation problems." (See our comments on p. 67.) Our recommendation is directed to the methodology used to generate cost-effectiveness data like that presented on page 38 of this report. Current USDA guidelines for reporting CRES data allow the combined soil erosion reductions of several conservation practices (a "system") to be attributed to a single practice (SCS National Bulletin No. 300-2-29, pp. 2, 3, and 6). This data on combined reductions is not an appropriate basis for determining the cost effectiveness of single practices. Our recommendation has been revised to clarify this point.]

CHAPTER 5

Recommendation 1

USDA has, for years, been using a variety of means to emphasize that the practices being cost-shared must primarily provide enduring conservation benefits. In 1979, ASCS eliminated from the ACP a number of practices considered to be oriented more to production than to conservation. During FY 1984, statistically valid data from CRES will be available to enable evaluation of the relative effectiveness of practices currently being cost-shared through ACP. Information from CRES will be available at all levels of USDA to aid in evaluating conservation program effectiveness.

[GAO COMMENT: Despite USDA's emphasis on practices primarily providing enduring conservation benefits, some questionable applications of practices have continued. Although consideration of a practice's conservation cost-effectiveness could be a major factor in addressing this issue, we believe that specific and detailed guidance and assistance approval certification, as described in our recommendation. is needed.]

APPENDIX VI

Soil protection and water conservation are without question the two top conservation priorities of USDA. It must be noted, however, that conservation and protection of agriculture's resource base is also very important to the future of our nation's ability to produce food and fiber. The priorities for the protection of that resource base is not always exactly the same as the priorities for soil and water conservation, as may be evidenced by the objectives of GPCP.

We have prepared and enclosed comments and corrections addressing various points raised in the Draft Report support material. We hope this information will be helpful in preparing a final draft of the report for Congress. The audit team is to be complemented for their efforts in preparing an objective quality report that reflects a concern for improving soil conservation effectiveness on a national basis.

Sincerely,

Daniel G. Amstutz
Under Secretary for International
Affairs and Commodity Programs

Enclosure

COMMENTS AND CORRECTIONS ON DRAFT REPORT "DEPARTMENT OF AGRICULTURE SOIL CONSERVATION PROGRAMS ARE NOT REALIZING THEIR FULL POTENTIAL IN THE WAR AGAINST SOIL EROSION."

1. On page iv, paragraph 2, line 15, the Draft Report states "USDA officials estimated that by October 1983 data from which such cost-benefit information could be developed will be collected from each of the Nation's nearly 3,000 counties." It should be noted this is the starting date for nationwide reporting, and that nationally valid data will not be available until later.

[GAO COMMENT: Revised as suggested.]

2. Page 22, paragraph 1, line 11 and page 48, paragraph 4, lines 1 to 3 are a direct conflict with ASCS operating procedures issued to State and county offices. Procedures state that cost-sharing shall not be approved on a first come, first served basis.

[GAO COMMENT: Both paragraphs have been revised.]

3. In line with the concern expressed in the letter about the fragile land statements, the last paragraph, page 22; the first paragraph, page 39; and the fourth paragraph, page 45 are the statements that are of primary concern. These sentences should be reworded to clarify that, in some cases, targeted money could be directed to highly eroding lands that can tolerate erosion losses with little or no impact on productivity at the expense of shallower or otherwise more fragile lands which are eroding at lower rates, but suffer larger losses of productivity due to erosion. Similar statements can be found at the bottom of page iii and the top of page 35.

[GAO COMMENT: See our comment on page 67. The last sentence of the last paragraph on page 45 describes our concern regarding fragile land and has not been changed. Revisions were made to the other cited passages to clarify our intent.]

4. On page 24, paragraph 2, the Draft Report states that ASCS officials could not furnish the basis of ACP State allocations, and that there was no discernible relationship between the CNI results published in 1967 and subsequent conservation fund allocations. We are concerned with the way this paragraph is worded. Although ASCS officials were not able to explain specific details on how the estimates of each State's needs were established in 1971, they explained that each year since the 1950's each State had received about the same proportionate share of total funding as in the prior year except for some minor adjustments.

Allocations since 1971 have been based on the 1967 CNI. From the CNI, ASCS estimated the types, numbers, and costs of practices each State needed. The needs data, which is the basis for allocations developed from the 1967 CNI, showed significant changes from previous needs estimates. Although there were significant changes in the needs estimates, each State's proportionate allocation for any year was not decreased more than 1% from the prior year due to a 1% limitation that has been in effect since 1952. However, over the past decade, the cumulative changes resulting from the 1967 CNI have caused significant changes to some State's initial allocation.

[GAO COMMENT: The second paragraph on page 24 has been revised and the two tables on pages 24 and 25 have been added to clarify our point that the rationale for the ACP funds distribution to individual States cannot be satisfactorily answered by the statement that they "have been based on the 1967 CNI." Additional response is included in our evaluation of USDA's comments on page 36.]

5. On page 25, paragraph 3, we agree with the paragraph as stated in the draft report. However, on line 6, after "However, the information in the table does not provide a measure of program effectiveness...", the following updating information needs to be added:

> It is planned for the 1984 FY ACP Statistical Summary to report, by practice, for the U.S., the tons of soil saved, average cost share per ton, acre-feet of water conserved. This would be in addition to the statistics already being reported in the Statistical Summary.

[GAO COMMENT: This information has been added at the end of the paragraph. However, these new data categories still do not measure program benefits on an effects-of-erosion basis. The categories "tons of soil saved" and "average cost-share per ton" can be made to look better, for example, if cost-share practices are installed primarily on lands having very high pretreatment erosion losses. (See table, p. 38.) Such a strategy, however, does not take into account that a direct correlation may not exist between the amount of soil movement and the degree of damage resulting from that movement. These new data categories will not answer the program effectiveness questions posed in the last paragraph on page 27.]

6. On page 40, paragraphs 1 and 2, and the second paragraph, page 42, the report discusses the need to change procedures and forms so that post-practice data and erosion reduction data can be attributed to a single practice. This was discussed with a GAO representative to explain further the effectiveness

of the "systems" approach, how data is reported for practices and components on the CRES form, and how it will achieve the objectives GAO felt should be accomplished. Both ASCS and SCS expressed concern that the report suggested returning to the "single practice" approach to conservation problems, which appears to be regressive. We hope this is not what was intended, but the present wording gives this impression to both ASCS and SCS. We ask that these paragraphs and similar statements throughout the text be restated if single practice emphasis is not the intent.

We do not agree that the CRES form should be revised to provide for collection of performance results for individual SCS components. The results of a system often cannot be attributed accurately to each individual SCS component. The results of installing a system of practices may be much greater than the sum of the results obtained from each individual SCS component. Furthermore, the number of CRES forms reporting only one SCS component will be sufficient to provide a valid evaluation of the effects of installing a single SCS technical practice.

[GAO COMMENT: We do not advocate that USDA return to a single practice approach to solving conservation problems. (See our comments pertaining to the systems/single-practice issue on pp. 67 and 72.) The final report has been revised to more clearly state our concerns about a potential methodology problem that could arise when CRES data is used to compute the cost effectiveness of individual conservation practices.]

7. On page 41, paragraph 3, the statement attributed to ASCS officials that CRES data would not be used was made in the context that it could not be the sole criteria, and that at the time the question was asked there was not enough counties reporting to establish national validity. ASCS will assuredly use CRES data as a major informational source in making future program assessments and resource allocations at the national level.

[GAO COMMENT: This paragraph has not been included in the final report. See our comment on page 70.]

8. On page 42, line 2, the Draft Report states, "Formula products are weighted, as shown below, to favor soils with higher prepractice erosion rates." This sentence is incorrect and should read as follows: "Formula products are weighted, as shown below, to favor soils with higher ratios of soil loss to T-value."

[GAO COMMENT: This information has been added.]

9. On page 42, paragraph 4, the table reflecting "prepractice actual erosion rate" is obsolete. The factors currently being used are as follows:

WEIGHTING FACTORS

PRETREATMENT EROSION RATE	T - V A L U E			
	T=2	T=3	T=4	T=5
T/ac/yr				
20+	1.3	1.3	1.3	1.3
18+ thru 20	1.3	1.3	1.3	1.2
16+ thru 18	1.3	1.3	1.3	1.1
14+ thru 16	1.3	1.3	1.2	1.0
12+ thru 14	1.3	1.3	1.0	.9
10+ thru 12	1.3	1.1	.9	.8
8+ thru 10	1.3	1.0	.8	.7
6+ thru 8	1.1	.8	.7	.7
4+ thru 6	.9	.7	.7	.7 1/
4 or less	.7	.7	0	0

1/ If prepractice erosion rate is not in excess of T, then the weighting factor is 0.

[GAO COMMENT: The table has been deleted and information about the revision of cost-share-formula weighting factors has been added in the last paragraph on page 41.]

10. On page 43, paragraph 1, the draft report should be reworded as follows:

The weights vary between .7 and 1.3 depending on the T-value for the land and the prepractice actual erosion rates. Those cases with higher ratios of soil loss to the T-value are favored. For example, for a soil eroding at 9 tons with a T-value of 2 the factor is 1.3. For a soil eroding at 9 tons with a T-value of 5 the factor is .7.

[GAO COMMENT: The paragraph USDA refers to has not been included in the final report.]

11. On page 43, in the 3rd paragraph, ASCS expressed concern with the report's criticism of computing variable cost-shares. The issue was discussed with a GAO representative to point out that the best available data is being used in the computation. In the 4th paragraph, extending to top of page 44, in the interest of accuracy the second sentence should read "...the criterion for determining the Federal cost-share rate should be changed from the current variable rate criterion which emphasizes reductions on soil movement relative to the T-value to one based (in the short-term) on cost-effectiveness at the local level and (in the long-term) on reductions in erosion's harmful effects."

[GAO COMMENT: The second paragraph on page 42 has been revised to clarify our concern that inappropriate data on erosion-reduction results not be used to undercut the variable-rate concept. The last paragraph starting on page 41 has been revised to recognize the soil-movement/T-value criterion.]

12. On page 43, paragraph 1, the 3 million acre figure is in error. Farmer's use of reduced tillage has increased from 29 million acres to 110 million acres. The 3 million acres refer only to the no-till acreage part of the 29 million acres.

[GAO COMMENT: The report has been revised accordingly.]

13. On pages 54 and 55 of the Draft Report, we believe the criticism of practices relating to improvement of irrigation systems does not give adequate weight to the other conservation objectives of USDA. In the USDA Program Report and Environmental Impact Statement responding to the provisions of the Soil and Water Resource Conservation Act of 1977 (RCA), the second and third objectives are to improve irrigation efficiencies and improve water management respectively. USDA has adopted as its second national priority the conservation of water used in agriculture in guiding its soil and water conservation activities. The Soil Conservation and Domestic Allotment Act (SCDA) directs the Secretary of Agriculture, in formulating the national program, to consider the need to conserve the water resources on agricultural land and to facilitate sound resource management systems through water conservation. GAO in a report to Congress has shown the need for conserving water through irrigation systems. These items show that the conservation and management of the national water resource is of prime concern, particularly in the arid west.

Pollution abatement and water quality improvement are other areas for which irrigation measures are used and in which USDA has responsibility, as reflected in both the response to the RCA and the SCDA. The Colorado River Basin Salinity Control projects are areas where practices to improve irrigation systems for improved water management are used to reduce the salt load in water returning to the Colorado River.

With the charges and priorities given us for water conservation and management we do not believe the ACP funds used for improvement of irrigation systems are misspent. While the practice may increase yields or reduce normal operating

and maintenance expenses for some producers, the practice can and does conserve water or abate pollution or salinity.

[GAO COMMENT: We agree that water conservation is and should be a major resource conservation program consideration. Throughout this report we have tried to emphasize USDA's multiple resource conservation responsibilities even though our review focused on USDA's highest conservation priority--excessive soil erosion. (See pp. i, 2, 3, 23, 29, 33, 48, and 54.) However, just as in the case of soil conservation practices, we question whether some of the applications of water practices cost shared with limited federal dollars provide benefits that are more production-oriented than conservation-oriented. We have revised some of the discussions in the report to emphasize that our concern is with the application of the practices, not the practices themselves. (See pp. 51 to 55.)]

14. On page 55, paragraph 1; page 56, first paragraph; and page 57, second paragraph, the statements are of concern even though the resulting conclusions and recommendations are proper. In keeping with the audit's direction of moving forward with procedure to more effectively utilize limited funds to address tomorrow's conservation needs, the wisdom of holding a program to a statement of goals made 28 years ago, before the program was initiated, seems inconsistent. GPCP should also be evaluated, as the other programs were, on the current goals as influenced by current technology, and what changes are needed to make it more effective in the future. GPCP today is the multi-objective program authorized initially by law. Consideration should be given by the audit team, utilizing the data shown, in addressing the need to adjust the program objectives to be more in line with the National Program for Soil and Water Conservation. If this was the intent, considerably less emphasis should be given to the 28 year-old testimony on establishing permanent vegetative cover, thus giving more visibility to the statements supporting the conclusion and recommendation.

[GAO COMMENT: Our discussion of GPCP in chapter 5 (see pp. 55 to 57) has been modified to more clearly make the point that the program has evolved from one originally enacted as a special program to address the unique climatic conditions of the Great Plains in counties susceptible to serious wind erosion, to a multi-objective program much like ACP.]

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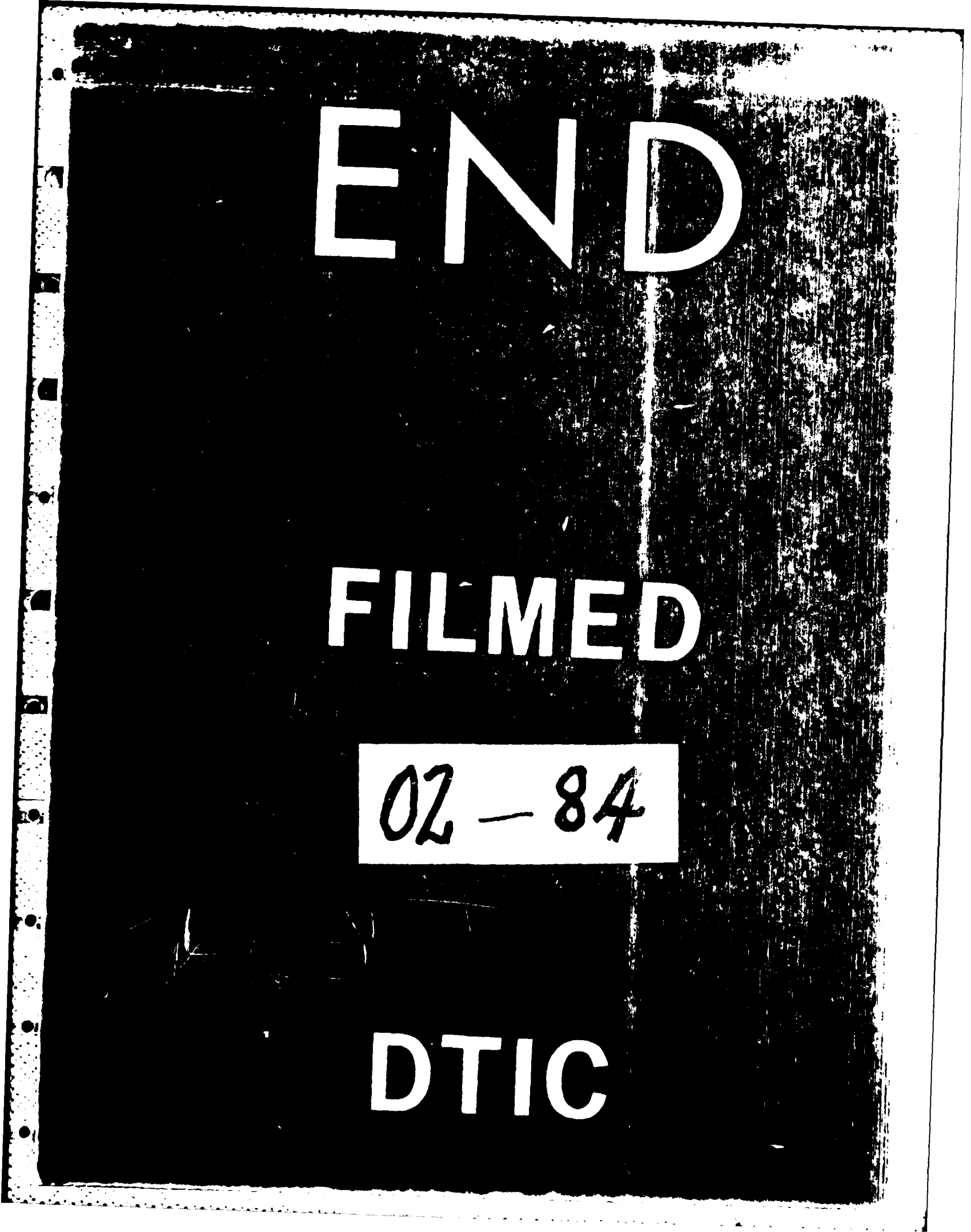
*U.S. GOVERNMENT PRINTING OFFICE : 1983 0-421-843/100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